UNIVERSITY OF CALIFORNIA.

THE ELECTRICAL WORLD

PUBLISHED EVERY SATURDAY BY

THE W. J. JOHNSTON COMPANY, Limited,

168-177 POTTER BUILDING, NEW YORK.

Established 1874. Incorporated 1889.

W. J. JOHNSTON, Prest. C. E. STUMP, Treas. and Bus. M'g'r.

Telephone Call: Murray 586. Cable Address: "Electrical," New York.

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EDWIN F. CLARKE, Manager.

SUBSCRIPTION, IN ADVANCE, ONE YEAR, $3.

(Including Postage in the U. S., Canada or Mexico.)

IN CLUBS of four or more, $2.50 a year each; with a free extra copy to the getter up of a club of 8. Foreign subscription, $5 a year.

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The Editor of The Electrical World, New York.

Subscriptions and communications relating to **advertising** or the **business department** should be addressed to

THE W. J. JOHNSTON COMPANY, Ltd.,
Potter Building, New York,
OR ANY OF THE BRANCH OFFICES.

VOL. XIII. NEW YORK, APRIL 13, 1889. No. 15.

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Paris Meter Competition. AS many of our readers are interested in the meter competition to take place in Paris, we would call attention to the announcement in another column in which the date, and the place, of delivery for the meters is given. Those who desire to enter the competition should lose no time in sending their apparatus abroad. The indications are that America will be represented by a large number of meters and stand a good chance of winning the prize.

Series Electric Railways in England. IT seems that notwithstanding the success which has attended the operation of electric railways on the plan of running the motors from constant potential circuits, experiments are still going on looking towards the operation of street cars by means of constant current; that is to say, placing the motors in series. Such a system was in operation for a while at Denver, Col., in this country, and, as will be noted, a similar installation has now been started in England. The details of the conduit and contact arrangements employed there are well worked out, and those who have undertaken the work are very sanguine of success.

Waterproof Electric Motors. SEVERAL months ago Mr. Frank J. Sprague excited amusement in some quarters by stating, as the result of his experiments, that he considered it possible to have in use electric motors that could be washed down with a hose after a day's run under a street car in dirty weather. The unbelievers will perhaps be interested therefore in the letter which we publish this week from Mr. Merle J. Wightman, in which he describes some remarkable tests of a Thomson motor, under the cold-water treatment. Motors of such hardy constitution as this, enabling them to withstand the worst ordeal that a sodden winter or a slushy spring could subject them to, have a great future before them.

Electrical Inventions. TO those who are inclined towards the opinion that invention in the field of electricity must in time narrow down, our list of patents this week must be a convincing proof that that time has certainly not yet arrived. We record no fewer than forty-one patents in all branches of the art, a number of which are of great importance. It is interesting to compare the diversity of those issued this week and the limitation of those expiring at the same time. The record shows that seventeen years ago electrical apparatus was mainly embraced within the field of telegraphy and kindred applications; and though this branch is even to-day by no means neglected, as the record shows, it has been far outdistanced by the other more modern applications.

Galvanometer Corrections. FOR those engaged in testing or experimental work in which the Thomson reflecting galvanometer is employed, the table which we publish in another column will unquestionably prove of great value. Mr. Kennelly with wonderful patience and exactitude has tabulated in very convenient form, the errors which are caused by doubling the angle of deflection, and which, as is well known, make the indications of the instrument too great. This error increases as the angle of deflection is increased, and as it is desirable to obtain as great a deflection as possible in many cases, it is doubly valuable to have a ready reference table from which the errors introduced may be read at a glance. Mr. Kennelly deserves the thanks of the profession for the work which he has undertaken in the tabulation of these correctional errors.

Adjustable Telephones. TELEPHONE subscribers in this country, educated as they have been to leave the care of their office telephone apparatus entirely in the hands of the inspector from "central," will be interested in a description which we give in another column of the telephone in use in connection with the Stockholm, Sweden, exchange. A most striking point in connection with the transmitter is the fact that it can be regulated by the subscriber himself, so that in case of bad working it will not be always necessary to call upon the exchange to hunt out the trouble. This may be, or may not be, an advantage, and the success of the plan must, we imagine, depend a great deal upon the intelligence of the subscriber. We do not think that the American telephone-using public is inferior in intellect to any other on the face of the earth; but we doubt whether the policy adopted by the Stockholm Telephone Company is one which would commend itself as useful here and as an improvement to the service, all things taken into consideration.

"Successful" Subway Tests. THE New York daily papers are congratulating the public on the success of the subways, as evidenced by the lighting up of a few arc lamps by cable through the subways at Broadway and Twenty-third street. "The test proved successful in every respect and justified the position taken by the Board of Electrical Control that the subways are perfectly practicable for the use of the arc lighting companies." With all due respect to these authorities we must express our fear that these congratulations are rather premature. The practicability of an underground system is not to be demonstrated by means of a single trial on a fine night. We are glad to see the circuit put in operation, and shall be happy to record its continuous success, but we would advise the newspaper electricians to wait a little. We recall from our own experience, and from the columns of this journal, many another experiment of underground arc circuiting that began well, but whose wires and lights have gone with the snows of yester year and with bank accounts that were not to be despised.

Wire Maps and Censuses. A GREAT many electrical companies doing local service in American towns and cities have maps showing their wires and pole lines. Such maps are a necessity, but it seems to us that Dr. Schuyler S. Wheeler, the electrical expert of the Board of Electrical Control, has hit upon a decided improvement that deserves general adoption, if not by the companies, at least by municipal authorities, as affording the opportunity and means of making a complete pole and wire census. His city map is 11 feet by 7, and on a scale of 200 feet to the inch. Each class of service is represented by a thread or string of special color, and the street electric lights are represented by brass, tin, copper and ordinary tacks, according to their ownership by the respective companies. The background to this is the city map, with the blocks and streets in black and white, so that as one looks at the map a most vivid idea is at once obtained of the overhead wires of New York. The subways are also shown graphically. This is an eminently useful piece of work, which will furnish a great many object lessons to all concerned.

Electricity in Music. ELECTRICITY, which has for some time past aided the organist materially in his work, by operating the pipe valves and pumping the organ, has now been called upon to do a further and most interesting work in connection with the piano. It already records the performance of a player, as in the Carpentier melotrope and melograph, but the latest advance in its application is said to go so far even as to sustain, increase and diminish the sound. These improvements, which are said to have been devised by Dr. Eisenmann, of Berlin, are supplemented by a still more remarkable effect, namely: the changing of the timbre of the instrument so that it approximates from the sound of the violoncello to that of the piccolo. This evidently is a remarkable achievement and will put in the hands of the piano player an instrument which will come near to the organ in its range of quality. It seems evident that the attraction of magnets exerted upon a vibrating string at different points may induce such overtones as to change its normal timbre; but it remains to be shown to what extent this can be done without interfering with the purity of the tone.

Superseding Compressed Air. THERE have been a great many discussions on the relative merits of electric, rope and compressed air transmission of energy, and probably our readers are familiar with the symmetric little tables which go to show that at a certain point electricity loses its advantages, and the other agencies are alone entitled to consideration. We have nothing whatever to say against these interesting analyses, but we cannot help being struck with the fact that in spite of such data electricity is being given the preference. The reason of this is that electricity has a great many conditions of superiority that do not lend themelves readily to expression in tables of percentages, but which are nevertheless very palpable and perceptible to practical men studying the problem. Our well-informed contemporary, the *Engineering and Mining Journal*, in speaking of the adoption of electric transmission at the Falls of Schaffhausen supplanting the wire rope, and of the statement that electricity is now admitted to be desirable for the Chapin mine, Michigan, in place of the big compressed air plant there, says: "It would seem therefore, that electrical transmission of energy is destined to supersede both wire rope and compressed air transmission, except, possibly, under circumstances which are specially favorable to the latter while unsuitable to the former. The results of experiments, as shown by the actual substitution of one system for the other, outweigh all arguments based on fine mathematical calculations, or on theoretical deductions, and we, therefore, attach special importance to this announcement." This is neatly stated, and its truth will soon be acknowledged.

Magnetism in a New Role. THE effect of the new theory, or rather the new method, of utilizing magnetism directly in the construction of electro-magnetic apparatus, is daily making itself manifest in a variety of novel mechanisms, and seems destined to cause a revolution in the treatment of many problems heretofore thought to be beyond the reach of practical solution. The consideration of the magnetic circuit as analogous to the electric circuit has already brought about a marked change in the method of constructing dynamos and dynamo-electric machinery generally, and the work of Hopkinson and Kapp in this direction will be fresh in the memory of our readers. Actual practice has substantiated the assumption that the magnetic circuit is subject to laws quite analogous to those of the electric circuit in such apparatus, and that in order to obtain the best results it must be taken into consideration in the building of such machines. The application of these principles to another class of apparatus of great importance at the present day, the converter, has now been effected in a beautiful manner by Prof. Elihu Thomson, and with the result that the range of the work to which the alternating current can be applied, is unquestionably largely increased. Our article in another column shows how, by means of a magnetic shunt, the quality of the secondary current in a converter, whose primaries are attached to a source of constant potential, may be varied at will to suit different methods of operation; and, thus, in fact, any quality of current may be obtained from an alternating current constant potential source. While we are not in possession of data which would indicate the efficiency of the new method of regulation designed by Professor Thomson, the method of regulation in itself is of sufficient value to insure its application in a variety of ways, a few of which are described in the article.

NEW BOOKS.

THE ECONOMIC VALUE OF ELECTRIC LIGHT AND POWER. By A. R. FOOTE. Cincinnati: Robert Clarke & Co. 1889. pp. 191. Price, $1.

In an interesting article by Mr. Kennan in the current *Century*, on the Russian police, it is stated that, by order of the central authorities, it is part of the duties of the force to compel indifferent or backsliding Christians to partake of the Holy Communion whenever they have been unmindful of that religious duty. Mr. Kennan thinks that this "is something that has not been seen outside of Russia since the dark ages." Perhaps not; but there are remarkable revivals, very near to it, in these times, of the old blind superstitions that induced nations to set up State church establishments, of which practice this Russian police regulation is a logical outcome. In this country, for example, we are pretty well cured of the idea that established religion supported by public taxes is a superior brand of article, but there are many among us who still believe that a cure for our social evils is an analogous establishment of State railways, telegraphs, steamships and telephones.

In keeping with the same political economy is the tendency that of late has so remarkably manifested itself in a great many towns and cities for the municipal acquisition and management of electric light plants. These columns have recorded scores of instances in which local funds to be raised by taxation have recently been voted for the purchase of electric light machinery, with which to light the streets. So far as we can judge from close observation, this manner of spending money is growing in popularity, and the phenomenon is one, therefore, to be studied gravely, not only in regard to its direct social and economic effects, but with respect to its influence on the progress of the electric light and power industry.

Such a study has been attempted in this pithy little book by Mr. A. R. Foote, who considers the use of local tax funds for the purchase of electric light plants to be improper and unprofitable, and who advocates, as an alternative and better plan, the bestowal in each place, on a responsible private company, of a broad but exclusive franchise, under which it shall meet the entire wants of the community for electric current for any purpose whatsoever.

As a sample of what results from municipal management of such business enterprises, Mr. Foote cites the dismal failure of the city gas service in Philadelphia—an instance that might be supported by many more, especially from the experience of sixty years ago, when some of the newer States and newer cities had a craze for backing and dabbling in all kinds of commercial and trading schemes, and in consequence ran up the huge debts which have since served as warnings and have prompted the enactment of severely rigid laws against increase of burdens of this character. It would be interesting to see an exhibit of the balance sheet of those disastrous investments. It is true that Prof. Ely has lately been publishing rosy figures as to the great returns from city lighting plants, gas and electric, but as Mr. Foote shows, and as in every case could be proven, the net benefit to the community is a vanishing quantity. Some day, possibly, the city of Philadelphia will be able to run a Wanamaker's store at a profit, and might as reasonably undertake the task as to supply gas; but, for the present, the conditions are against success. The philosophy of the influences that make against success was well summed up by John Stuart Mill in a brief passage: "The inferiority of government agency in any of the common operations of industry or commerce is proved by the fact that it is hardly ever able to maintain itself in equal competition with individual agency, where the individuals possess the requisite degree of individual enterprise and can command the necessary assemblage of means."

We recommend our readers to acquaint themselves with the contents of Mr. Foote's remarkably timely book. While, like ourselves, they may be glad to see the extension of electric light and power in every way, they will, probably, after its perusal at least, come to think that there are better methods for its advancement and its perfection than the present popular one of raising special taxes and running a community into debt.

Mr. Foote supplements the argumentative portions of his work with numerous articles, papers and statistics bearing on the economic value of electricity, and by a pithy and instructive section on electrical terms, units, etc., compiled by Mr. A. V. Garratt.

The Correction of Error in the Scale of Thomson Galvanometers Due to the Doubling of the Deflection Angles by the Reflected Beam of Light.

BY A. E. KENNELLY.

It frequently happens that in making electrical measurements with the aid of a Thomson mirror galvanometer, it is desirable to employ comparatively large deflections for the sake of convenience as well as acccuracy. Thus in comparing two resistances in series traversed by a steady current, applying the electrodes of the galvanometer to the terminals of each successively in the usual way, it is important to obtain large deflections in order to magnify as much as possible whatever difference may exist between them. The effect of doing so, however, is to in-

TABLE OF THOMSON GALVANOMETER SCALE ERRORS DUE TO THE DOUBLING OF THE DEFLECTION ANGLES BY THE REFLECTED BEAM OF LIGHT.

BY A. E. KENNELLY.

OBSERVED DEFLECTIONS.

Perpendicular Range.	100	1000	1050	1100	1150	1200	1250	1300	1350	1400	1450	1500	1550	1600	1650	1700	1750	1800	1850	1900	1950	2000	2050	2100	2150	2200	2250	2300	2350	2400	2450	2500	2550	2600	2650	2700	2750	2800	2850	2900	2950	3000	Perpendicular Range.
50	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	50
60	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	60
70	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	70
80	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	80
90	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	90
100	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	100
110	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	110
120	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	120
130	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	130
140	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	140
150	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	150
160	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	160
170	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	170
180	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	180
190	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	190
200	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	200
210	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	210
220	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	220
230	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	230
240	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	240
250	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	250
260	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	260
270	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	270
280	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	280
290	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	290
300	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	300
310	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	310
320	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	320
330	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	330
340	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	340
350	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	350
360	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	360
370	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	370
380	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	380
390	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	390
400	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	400
410	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	410
420	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	420
430	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	430
440	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	440
450	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	450
460	2.05	2.05	2.05	2.05	2.05	2.05	2.05	2.05	2.05	2.05	2.05	2.05	2.05	2.05	2.05	2.05	2.05	2.05	2.05	2.05	2.05	2.05	2.05	2.05	2.05	2.05	2.05	2.05	2.05	2.05	2.05	2.05	2.05	2.05	2.05	2.05	2.05	2.05	2.05	2.05	2.05	2.05	460
470	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	470
480	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	480
490	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	490
500	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	500
Perpendicular Range.	100	1000	1050	1100	1150	1200	1250	1300	1350	1400	1450	1500	1550	1600	1650	1700	1750	1800	1850	1900	1950	2000	2050	2100	2150	2200	2250	2300	2350	2400	2450	2500	2550	2600	2650	2700	2750	2800	2850	2900	2950	3000	Perpendicular Range.

These Corrections are to be Subtracted from the Observed Deflections.

troduce an error in the scale, which while trifling for small deflections, rapidly assumes notable proportions as the latter increase, owing to the fact that the angle described by the beam of light is necessarily twice the angle through which the suspended mirror is deflected. The Thomson galvanometer being essentially a tangent instrument, the tangents of the angles described by its needle are, with properly designed coils and within reasonable limits, proportional to the strengths of the traversing current, and if the beam of light were carried rigidly round with the mirror, perpendicular to it, like a material index, the scale deflections would represent those tangents, and consequently those current strengths in strict proportion; whereas the deflections actually observed are in the ratio of tangents of double the deflection angles in every case, which is not strictly an equivalent result. These facts are alluded to in Kempe's "Handbook of Electrical Testing," and a formula is there given for determining arithmetically the discrepancy in any case; but the corrections so computed involve considerable labor and cannot usually be performed with any advantage by the use of logarithms, owing to the large number of digits it is necessary to retain in the operation. The error for any given deflection of course varies with the distance between the mirror and scale. At the common range of one metre perpendicular distance, and with a scale of forty divisions to the inch, the discrepancy amounts to an excess of 2 at 300, 6 at 400, and 12 at 500 divisions deflection, obviously a very appreciable amount.

The accompanying table has been computed for practical use in overcoming this difficulty, and by its aid the observed deflections can be reduced to the proper proportionality with ease and rapidity. It gives the correction for every 10 divisions of deflection up to 500, for every 50 divisions of range between 1,000 and 3,000 divisions perpendicular mirror distance, limits ordinarily represented by about two feet and six feet respectively, and which will probably cover all ordinary cases. With good focal adjustments, it is of course quite possible to estimate the amount of any steady deflection to one-tenth of one division when necessary, and consequently it is worth while having the corrections tabulated to the first decimal place.

They were actually computed to the second decimal, a degree of accuracy quite superfluous. For the sake, however, of possible extensions to longer ranges, which the table can be made to supply, or for assistance in interpolating intermediate corrections, a compromise has been effected, and the results are stated to 0.05, or one-twentieth of a division.

To employ the table the scale should be set strictly parallel to the plane of the galvanometer coils, and with the zero opposite their centre. The perpendicular distance from the mirror to the scale should then be measured and referred to scale divisions. Thus a distance of 3 feet 6 inches (42 inches) would correspond to 1,680 divisions, if these are 40 to the inch. The nearest set to this number in the table appears in the column headed 1,700. If, then, the observed deflections from the zero at the centre of the scale be, say, 120, 260 and 470 divisions to the right or left, the corrections on the lines appertaining to those numbers are seen to be 0.15, 1.5 and 8.65, respectively, which must be subtracted; so that the corrected readings are 119.85, 258.5 and 461.35, or, for ordinary purposes, 120, 259 and 461.

The correction for intermediate deflections can be estimated by inspection; thus for 355 divisions at the same mirror range it would be midway between 3.65 and 3.95, or 3.8; and similarly for any other case.

If a galvanometer be permanently set up at its best focal scale distance, it will be found convenient to inscribe its series of corrections on the scale above the points to which they apply, so that when accuracy is needed the subtraction can be effected mentally, coincidently with each observation.

It is hardly necessary to observe that these corrections cannot be applicable to deflections that are taken from a zero point other than the scale centre at the foot of the perpendicular from the mirror, or in the immediate vicinity, since the tangent law does not apply to departures from any other zero.

FIG. 1.—DETAILS OF THE ERICSSON TELEPHONE USED IN THE ALLMANNA EXCHANGE, STOCKHOLM.

The corrected readings will then truly represent the proportional strength of current in operation, provided that the instrument be of proper design, so that the field of magnetic force remains sensibly uniform throughout the range of the needle's motion, and also if the torsion effect of the suspending fibre be negligible. Generally speaking, for accurate observations, the fibres are too short and thus introduce a slight torsion error appreciable at large deflections. When this is the case, and it is desirable to obviate this disturbance, the amount of error so produced may be determined experimentally, or a longer suspension must be substituted.

The method adopted in computing the table has been the following;

Let θ be the angle of the needle's deflection.

Then 2θ will be the angle of beam deflection and the reduction factor x will be such that its product, with the tangent of 2θ, will produce the tangent of θ, or,

$$x = \frac{\tan\theta}{\tan 2\theta} = \frac{\sin\theta}{\cos\theta} \times \frac{\cos 2\theta}{\sin 2\theta} = \frac{\sin\theta}{\sin 2\theta} \times \frac{\cos 2\theta}{\cos\theta}.$$

Expanding each factor exponentially we have readily

$$x = \tfrac{1}{2}(1 - \theta^2 + a\theta + b\theta^3 + \text{etc.});$$

and rejecting powers above the fifth,

$$x = \frac{1 - \theta^2}{2}.$$

So that if d_1 and d_2 be any observed deflections, and D_1 and D_2 the corresponding corrected deflections,

$$D_1 : D_2 :: d_1\left(\frac{1-\theta_1^2}{2}\right) : d_2\left(\frac{1-\theta_2^2}{2}\right)$$
$$:: d_1(1-\theta_1^2) : d_2(1-\theta_2^2).$$

Consequently to this degree of approximation each deflection has to be reduced by the quantity $d\ \theta^2$, and the value of this quantity was first calculated throughout. The amount of error then remaining was determined by trial and duly applied throughout by proportional parts.

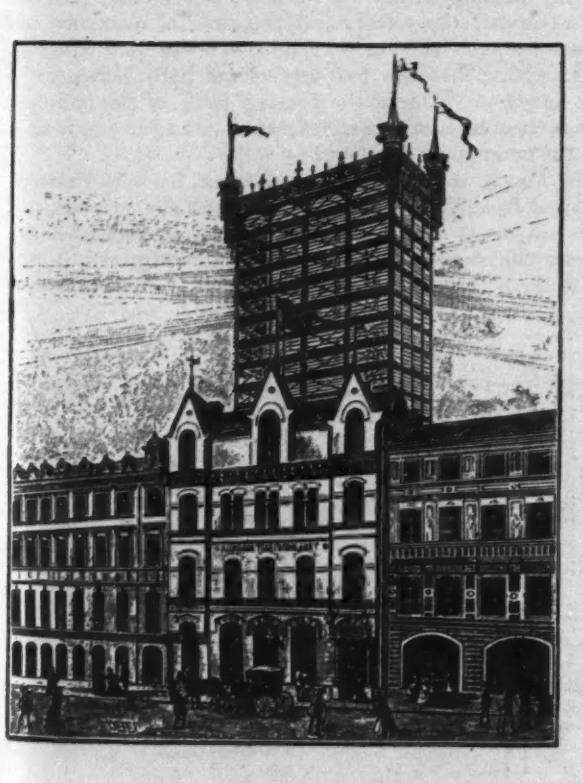
The New Telephone Exchange at Stockholm, Sweden.

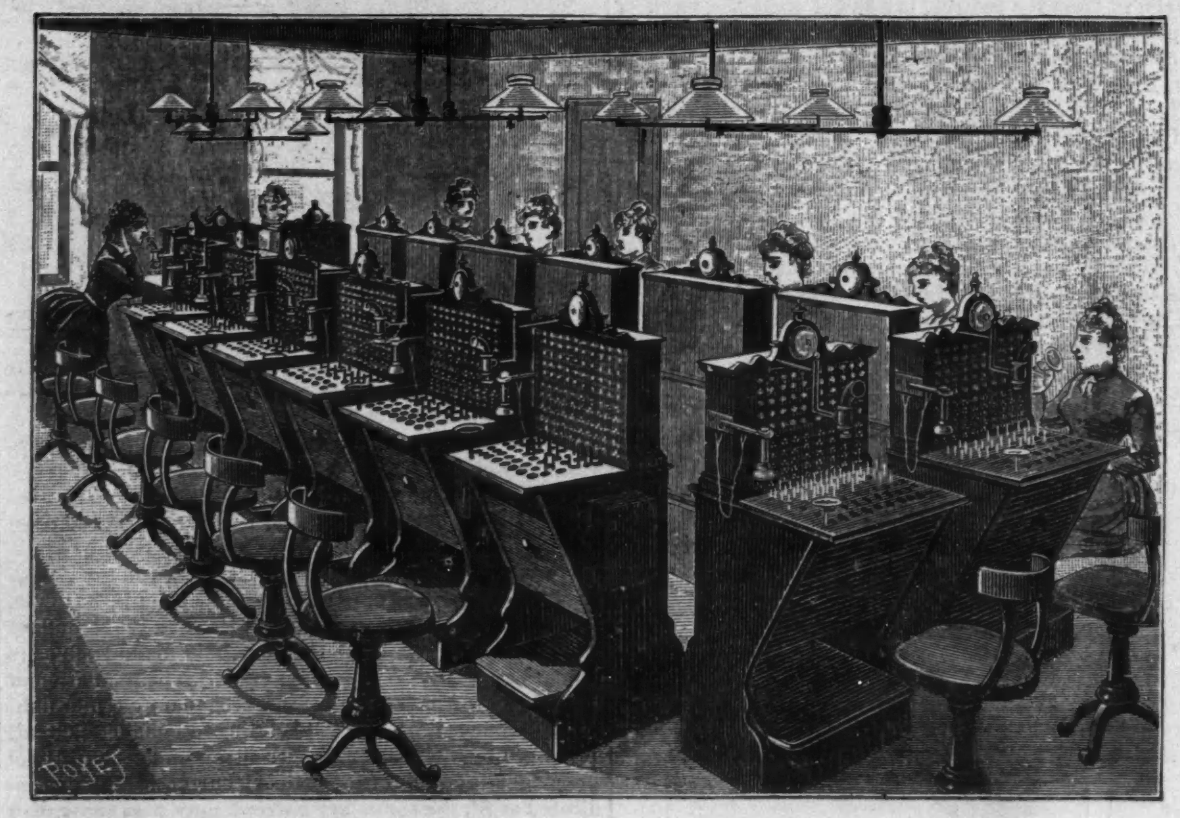
In 1883, the Allmanna Telephone Company established an exchange in Stockholm, Sweden. Since that time quite a number of modifications have taken place both in the apparatus and in the exchanges generally. The subscribers' apparatus employed is that of the Ericsson Company, and is represented in the engraving, Fig. 1, taken from *La Nature*.

The transmitter, as will be seen, is attached to the upper part of a standard resting on a base, which also carries a call bell, and the receiver is carried at the side. The transmitter *B*, shown in section, consists of a very flexible diaphragm *S*, in the centre of which is fixed a small disc of carbon, against which bears a platinum wire which constitutes the microphone contact. The platinum wire is carried by a metallic cylinder fixed at the end of a screw, *e*, with a milled head, and is maintained in contact with the disc of carbon by means of a spring *f* placed in the interior. The object of this arrangement is to permit of easy and at the same time sensitive regulation by a small turning of the head of the regulating screw. The subscriber himself can therefore regulate his apparatus according to his own special requirements. The other arrangements of the apparatus, so far as the induction coils are concerned, do not differ essentially from those in general use.

At the time that the system was first introduced the company erected three exchanges, one in the northern, one in the southern part and one in the centre of the city. At first these exchanges were in operation only during certain hours of the day, but the time was gradually increased until they are now open night and day.

The engraving, Fig. 3, gives an interior view of one of the exchanges, the northern. A series of desks with elevated backs are placed back to back; the annunciators are placed directly before the operator on the raised backs,





FIGS. 2 AND 3.—EXTERIOR AND INTERIOR OF THE ALLMANNA TELEPHONE EXCHANGE, STOCKHOLM, SWEDEN.

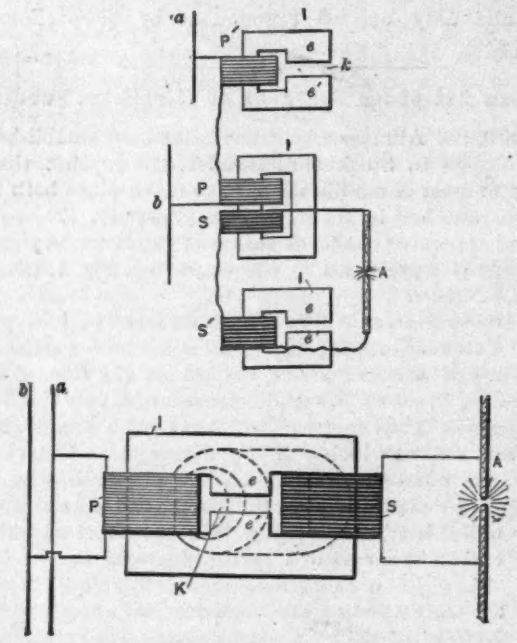
and the switch tables are placed directly in front of her. The general arrangements do not differ much from those now in vogue.

With the increase in the number of subscribers it was resolved to increase the number of exchanges, and to unite them all with the northern exchange. The old exchange being inadequate to accommodate the new business, a new one was erected, which is shown in Fig. 2. On the roof of the building there is an immense tower constructed of a series of girders and lattice work. This tower carries 8,000 procelain insulators supported on iron rods, and which carry the circuits, consisting of phosphor bronze wire, one millimetre in diameter. All the lines in Stockholm are overhead. When this building was finished, all the circuits were transferred to it and it became necessary to

THESE CORRECTIONS ARE TO BE SUBTRACTED FROM THE OBSERVED DEFLECTIONS.
[The Electrical World.]

replace the old station by the new one. The work was effected during the night, in 4 hours and 17 minutes, thus practically entailing no interruption of the service whatever.

In 1886 the number of the company's subscribers in Stockholm was 3,600, and the number of messages transmitted was 5,802,063, *i. e.*, 18,222 a day, or between 5 and 6 per subscriber per day. The total length of circuits was 5,287 kilometres. In 1887 there were 4,015 subscribers; 6,462,548 messages were transmitted, *i. e.*, 20,590, or between 5 and 6 per day for each subscriber. The length of the circuits then exceeded 7,058 kilometres. On Oct. 1, 1888, there were 4,300 subscribers, and the number of



Figs. 1 and 2.—Thomson's Method of Regulating Current in Transformers.

communications per subscriber per day had increased to between 6 and 7. The number of operators does not exceed 80.

Prof. Elihu Thomson's New Method of Regulating Current or Potential in the Secondaries of Transformers.

It is but a few years since the designing of electro-magnetic machinery, in the broad sense of the word, was more a matter of trial and error than of calculation; and although in the case of the dynamo good machines were developed from the process, it was not until the work of Hopkinson, Kapp and others on the construction of these machines appeared that dynamo building can be said to have been reduced to an accurate scientific basis.

The principal factor which characterizes the new method of dynamo construction is the treatment of the magnetic circuit in the same manner as the electric, so that the "resistance" of the magnetic circuit has come to be quite as important a consideration as the electric.

Without entering further into the importance of taking this factor into account, we desire to draw attention to a beautiful application, by Prof. Elihu Thomson, of the theory of magnetic resistance to the regulation of alternating current apparatus so that either constant potential or constant current can be maintained in the secondaries of transformers, independent of the external resistance of the circuits. While primarily designed for

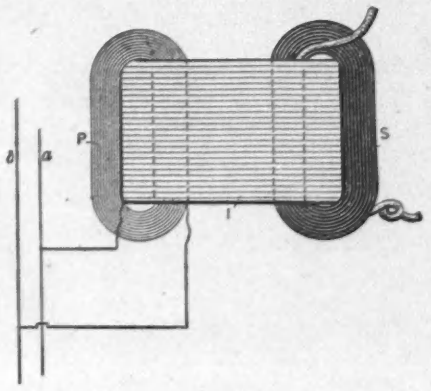
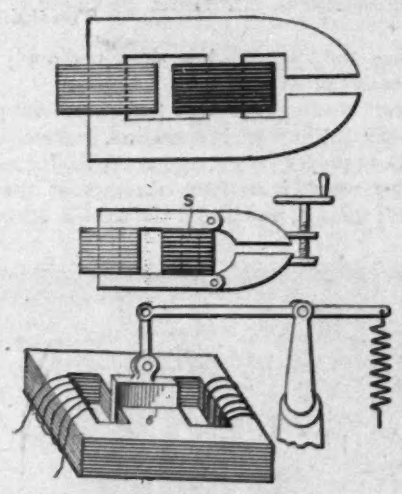


Fig. 3.

the purpose of maintaining constant alternating currents such as would be required for arc lamps, the method is applicable to other purposes, as will be described later. The regulation is effected by the direct action of the lines of magnetic force themselves, in concentrating or focusing themselves across a narrow non-magnetic space, forming a partial break in what would otherwise be a perfectly closed magnetic circuit for the magnetism developed by the current of the coil in question.

The method employed by Professor Thomson will be best understood by referring to the diagram, Fig. 1. Here *a* and *b* are alternating current constant potential mains, the coil *P* being connected to them as a primary, *S* being the secondary, and both being wound on the same core. We will suppose that the number of turns in *P* or in any coil in circuit with it, as *P'*, is such that, having reference to the potential of *a b*, very little current will pass in *P* when the circuit of *S* is open. *P'* is an additional coil wound on an iron core *I*, in which core the alternating currents will obviously produce an alternating magnetism, and if the core of this coil were continued around so as to be endless, there would be a magnetic circuit entirely closed and a maximum of reactive effect in the coil *P'* opposing the passage of current from *a* to *b*. Instead, however, of making the magnetic circuit completely closed, the core is provided with projections *e e'*, which are brought rather closely together, with, however, a determinate air-space between them, forming a partial break in the closure of the magnetic circuit for the magnetism developed by the current flowing from *a* to *b*. The space forms an air or magnetic resistance to the closure of the magnetic circuit for coils *P'*, and, as will be obvious, the more perfect the closure of the magnetic circuit at this variable point the greater will be the reaction upon the currents flowing from *a* to *b* through coils *P'*. During normal flow of currents from *a* to *b* there is a definite degree of closure of the magnetic circuit at *k*, dependent upon the width of the space and the number of magnetic lines of force which, with the given strength of magnetism in the core of *P*, may force themselves across the space. If there is any tendency to increase in the magnetism of the core of *P'*, the lines of force concentrate or mass themselves together in the space across *k* and become less diffused. By this means the degree of closure of the magnetic circuit of the core is increased and the reaction in coils *P'* increased. This variation of partial magnetic closure or variation of magnetic resistance obviously takes place independently of the magnetic circuit formed by the core threading the coils *S*.

Leaving out of consideration the coil *S'* in the circuit of *S*, the operation in regulating or adjusting the current in the circuit of secondary *S* is as follows: When there is a tendency to increase of current in the circuit of *S*, due to decrease of resistance, there is an attendant decrease in the counter electromotive force of the primary coil *P*, as is well understood, and there would hence be a tendency to increase of flow in the coil *P*; but with an increase of flow in the coils of *P* there is also an increase in the coils of *P'*, and an increase in the number of lines of magne-



Figs. 4, 5 and 6.

tism which pass over the magnetic resistance at *k* is produced. Inasmuch as the reaction of the coil *P'* depends upon the amount of magnetic disturbance set up in its core or the number of lines passing from *e* to *e'*, it is obvious that the currents flowing from *a* to *b* will meet an increased self-inductive reaction, and the current on the secondary circuit *S* will be cut down.

As the rate of variation of closure at *k* may be varied by any desired means, and may, in fact, be determined by the width of the space *k*, it is obvious that the regulation or the adjustment of current in the circuit of *S* may be of any desired nature. The prime object is, however, to secure a practically constant current in the secondary circuit, and the width of the gap *k* is made such as to produce as near as may be that effect. The regulation of the current or potential in the secondary circuit might also be produced by variably closing a magnetic circuit developed by the secondary current and independently of the magnetic circuit of the primary current. Thus, as indicated at *S'*, the secondary current may pass through a coil which shall set up magnetic effects in a core having a partial magnetic closure of variable amount, as at *k*. In this case the same effect of a reduction in the current or potential of the secondary is produced by the variation in inductive reaction at the coil *S'*, secured by variably closing the magnetic circuit of the core of *S'* at *k*. The effects produced by the variation of magnetic closure of the core excited by the secondary current might obviously be used alone or in conjunction with similar effects produced in the primary, as at *P*.

Instead of varying the magnetic closure of a core surrounded by a separate coil, as shown in Fig. 1, the magnetic circuit for the portions of core of the coils *P S* themselves may be variably closed, each portion of core having its magnetism closed without passing through the other portion, as shown in the coil Figs. 2 and 3, which is the actual construction adopted. This is accomplished by means of projections *e e'*, extending from some part of the iron core or circuit which threads both the primary and secondary coils, the projections being separated from one another by a space *K*, forming a magnetic resistance similar to the space *k* of Fig. 1. By means of the variable magnetic resistance formed at *K*, the magnetism developed in the portion of core surrounded by the coil *P* is variably closed. In fact, the magnetism can work, as it were, through two magnetic circuits, one including the space or resistance *K* and the other including the portion of core passing through the coil *S*. The magnetic lines developed by the core or coil *P*, which pass through the air space at *K* and escape the coil *S*, produce wholly self-inductive effects, resulting in an opposition to the flow of the primary currents, while all the lines developed by the coil *P*, which pass through the axis of the coil *S* result, as usual, in the production of secondary currents.

It will be readily seen that, as before described, any tendency to increase of the current flowing in coil *P*, re-

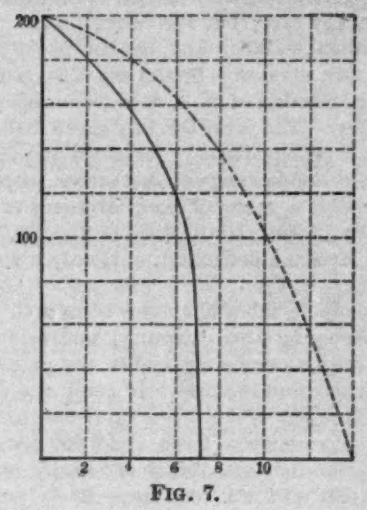
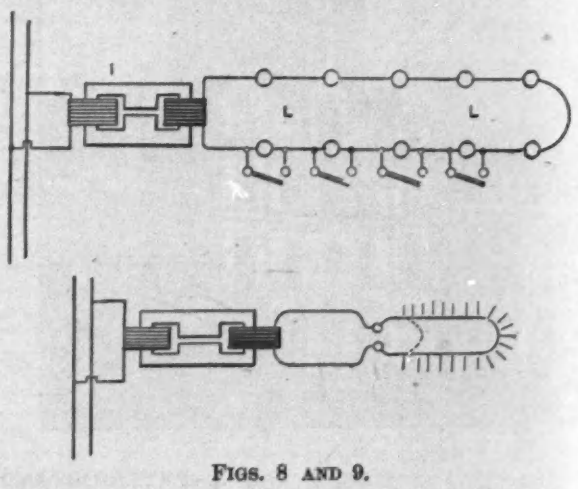


Fig. 7.

sulting from a lowering of the resistance in the circuit of *S*, will be at once followed by the development of increased magnetization of the proportion of core in coil *P* by the formation of increased magnetic lines across the air-space, while at the same time the self-induction of the coil *S* itself will undergo an increase, owing to the fact that a path of variable closure for the magnetism in the core is likewise formed across the space *K*. In fact, the effect of a slight increase of current in the coil *S* would be to oppose the passage of the lines of force tending to pass through its coils from the coil *P* and cause them to be shunted across the space *K*. The result of all this is that the varying resistance in the circuit of the secondary *S* would receive a current which tends to be limited in strength and to be self-regulated through the provision of the variable magnetic resistance formed at the point *K'* on partial closure of the magnetic circuit for the cores of the coils. As will be observed, the effects and principle of operation are much the same as before explained in connection with Fig. 1, excepting that the partially closed path here permits the added effect due to the beating back of the inducing magnetism in *S*, and in effect results in a shunting from *S* of the magnetism developed by coil *P*.

In Fig. 2, *A* represents an arc lamp, fed with constant current from the secondary *P*, although the primary coil *S* is subject to constant potentials. If the distance between the projections *e* be properly determined, it will have the peculiar property of producing in the secondary



Figs. 8 and 9.

coil *S* a droop or fall of electromotive force when the resistance is cut out of the circuit, and this fall may be made nearly proportionate to the fall of the resistance, or diminishing resistance, in the circuit, thus maintaining the current constant.

The partial closure of the magnetic circuit of the core *I* may be produced outside of both coils *P S* instead of between them, as shown in Fig. 4. Other methods, such as illustrated in Figs. 5 and 6, may also be employed, and a variety of others which will readily suggest themselves.

The full line, Fig. 7, illustrates what may be called the "characteristic curve" of the secondary currents in such a coil as Fig. 2, the verticals or ordinates representing the electromotive forces evolved, and the horizontals or abscissas the current strengths corresponding thereto. At electromotive forces below one hundred, as shown, the

curve is almost a vertical line, showing that a constant current is evolved at any resistance below that corresponding to a potential of one hundred. The dotted curve represents the case of drooping or falling potential with increase of current, such as is obtained with some special arrangements, such as that shown in Fig. 1.

While, as stated above, the method is applicable primarily to the operation of arc lamps on constant potential alternating circuits it has a variety of other uses. Thus it may be employed to maintain constant current in a num-

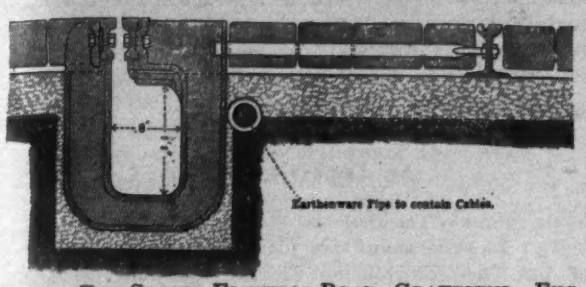


FIG. 1.—THE SERIES ELECTRIC ROAD, GRAVESEND, ENGLAND.

ber of incandescent lamps placed in series, as shown in Fig. 8, any one or all of which may be switched out of circuit without danger. Another application is the maintenance of a wire at uniform heat independent of the length in circuit, as shown in Fig. 9. Still another is the use of the method for maintaining a constant current in electric furnaces which, as is well known, are liable to sudden and great fluctuations in current, and thus are a constant menace to the dynamo feeding them. Other applications will readily suggest themselves, but enough have been mentioned to indicate the wide scope of Professor Thomson's method of alternate current regulation.

Sprague Electric Transfer Table at Altoona, Pa.

Our readers will remember that some time ago the Sprague Electric Railway and Motor Company fitted up an electric transfer table for the Chicago, Burlington & Quincy Railroad Company, at Aurora, Ill. This has been in successful operation ever since, and now the Pennsylvania railroad has recently equipped its transfer table at the Altoona shops in a similar manner. The accompanying illustration, Fig. 1, from the *Master Mechanic*, shows the table in plan view, and Figs. 2 and 3 show sections on the lines *C D* and *A B* respectively. The table itself is 60 feet long and 17 feet wide, and runs over a distance of 295 feet. It rests on eight rails, and is supported by four trucks. The motion is imparted to the table by a ten horse-power Sprague electric motor, flexibly suspended at the centre of the table, between the two middle trucks, and geared to the four outside wheels. By means of a link the motor can be thrown out of gear of the propelling wheels, and thrown into gear with a capstan, situated at the centre of the table, whereby the cars are drawn upon the table.

The speed of the motor is governed, and the table started and stopped, by means of a switch upon the centre truck. This switch throws the winding of the motor coils into different combinations, thus altering the current through the motor, and therefore its speed, without the use of an idle resistance, similar to the method employed on the Sprague electric cars.

The current is taken to the motor in a very ingenious manner, by means of a conductor placed underneath a wooden beam in the centre of the tracks, and held at a height of fourteen inches above the ground. By means of this underneath situation, the conductor is fully protected from all damage from accidental concussion, or from any other cause. From this conductor the current passes to the motor by an underneath running trolley wheel, which is kept tightly pressed against the conductor by means of suitable springs. The power for operating the transfer table is furnished by the main engine in the repair shop, some 500 feet away, where there is an Edison dynamo, which feeds the current into the wires which connect the shop with the transfer-table.

The details of the arrangement present a number of interesting features. As will be seen, the motor *A A* is supported on the shaft *B* and the springs *J J*. The pinion 1 on the armature shaft meshes with the gear 2, which drives the shaft *B*. From this shaft the power is transferred by means of gear 3 to gear 4 on shaft *C*. This gear (4) is free to rotate on shaft *C* and is made to drive it by means of the clutch *K*. The pinion 5, also loose on the shaft *C*, is driven by clutch *M*, and in turn drives shaft *D* by means of gear 6. Shaft *D* is the traction shaft and propels the table direct.

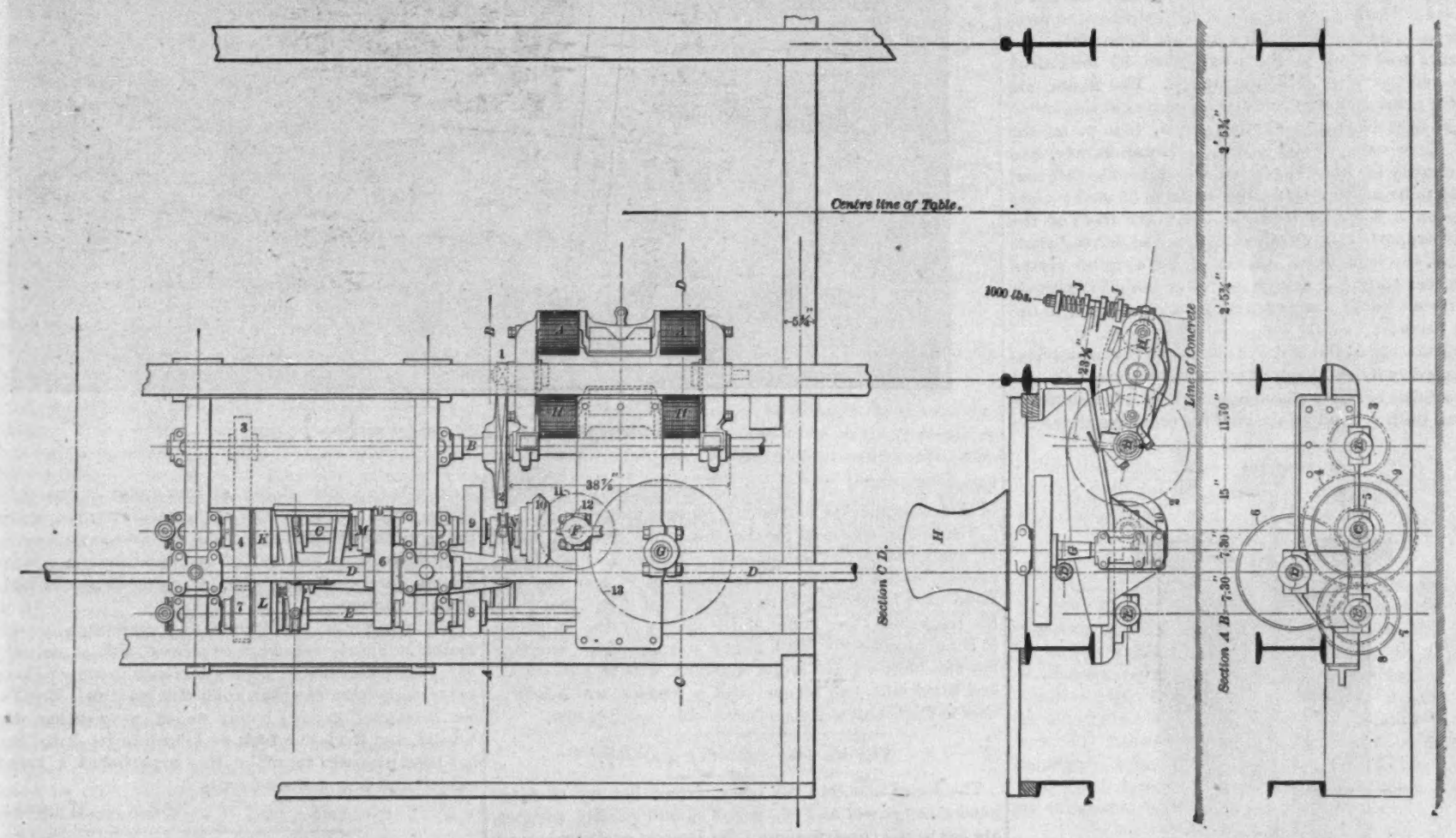
The table is provided with a capstan, *H*, by which cars can be drawn upon it. To operate this the clutch, *M*, is thrown out so that the table will not move, and the clutch *N* is thrown in, thereby causing the bevel gear 10 to revolve with shaft *C*. This meshes with the bevel gear 11 on the upright shaft *F*, the upper end of which is provided with a pinion 12, which engages the gear 13 on capstan shaft *G*.

If it is desired to alter the ratio of speeds between the capstan and motor, or between traction wheels and motor, the clutch *K* is disengaged, and the clutch *L* thrown into contact with the gear 7, which previously had been revolving idly on shaft *E*. This shaft (*E*) now drives shaft *C* by means of the gears 8 on *E*, and 9 on *C*, and the traction shaft and capstan are driven as before by the engaging of clutches *M* and *N*.

When gear 4 is engaged with clutch *K* on shaft *C* the gear 7 on *E* is free, and when it is held to its shaft by clutch *L* gear 4 is always free. Gears 8 and 9 being fast to their shafts keep *E* revolving at all times, but it is only when the ratio of speed is increased by clutch *L* being engaged, and *K* free, that *E* is used to transmit power.

The advantages of using electric power for this work are manifold; among them may be mentioned the lightness of the machinery which has to be moved (the motor used weighing less than 800 pounds), increased ease and convenience in operating the machinery, and great economy in its use.

We understand that the Sprague Electric Railway and Motor Company, of New York, have received another order for electrical apparatus for this same kind of work from the Philadelphia & Reading Railroad. Both of these orders are the direct result of the success of the electric transfer table at Aurora, Ill.



FIGS. 1, 2 AND 3.—THE SPRAGUE ELECTRIC TRANSFER TABLE AT ALTOONA, PA.

The Series Electric Railway at Gravesend, England.

Our readers will remember the system of electric railways which we described some time ago* as having been laid down at Denver, Col., and later on at Columbus, O. This system is known as the Short series electric railway, from the fact that instead of the usual method of running in parallel on a constant potential circuit, the motors on the cars are operated in series on a constant current circuit, the potential varying with the number of cars in circuit. As we have already described the system in full,

FIG. 2.—THE SERIES ELECTRIC ROAD, GRAVESEND, ENGLAND.

we will not enter into details here, further than to recall the fact that each car carries an arrow, which travels in a slotted conduit, and makes and breaks contact successively with spring clips included in the main circuit. When these clips are separated by the arrow the current passes to the motor on the car; and as the latter passes on, the clips close and preserve the main current intact.

Recently a similar system has been put in operation at Northfleet and Gravesend, England, by the Series Electrical Traction Syndicate, Limited. The electrical details do not differ essentially from those described by us, but some of the constructional methods relating to the road-bed and conduit are worthy of notice.

In order to make the system suitable for adoption in ordinary roads and streets, the first point considered was the construction of such a conduit as would cause the least possible interference with the surface of the roadway, and one that would be of sufficient structural strength to provide for the heavy traffic of large towns. In order to avoid a greater interference with the surface of the road than is common to ordinary horse tramways, it was decided in the first instance that the conduit should be laid directly under one of the track rails, and not, as in the case of cable tramways, centrally to the track. The further consideration of interfering as little as possible with the water and gas mains existing below the surface of the road required that this conduit should be kept to the smallest possible dimensions consistent with practicable working.

The tube, as constructed for Gravesend and shown in Fig. 1, is 8 inches in width, the bottom being 13 inches below the surface of the road. The slot through which contact is made between the underground conductor and the car motor is formed by leaving a space of $\frac{1}{4}$ inch between two bull-headed rails, somewhat similar to the ordinary Vignoles. The other track rail is of th ordinary girder type, the gauge being maintained

*See THE ELECTRICAL WORLD, April 2, 1887.

by means of tie-bars attached to the girder rails and the cast-iron yokes. Along each side of the track, buried in the concrete, is an earthenware tube, 3 inches in diameter, the ends of which protrude into the cavity formed under the conduit hatches where they are open for access. Into these tubes are drawn lengths of about 21 feet of Henley's highly-insulated ozokerited rubber cable,

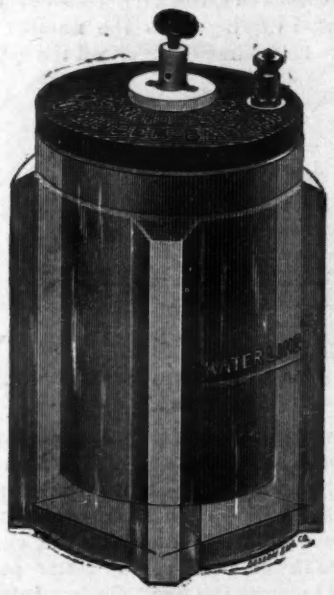


FIG. 1.—THE HOLTZER BATTERY.

of an insulation resistance of 7,500 megohms per mile, and also the unbroken return cable from the extreme end of the line, it being considered essential in this system that the earth should form no part of the circuit.

These short lengths of highly insulated cable are the only conductors between the "spring jacks," the conduit between being only for the passage of the arrow, and, therefore, otherwise empty. In each conduit chamber is placed a "spring jack," Fig. 2, consisting of a pair of glazed earthenware blocks, 14 inches by 3 inches by 4 inches, supported on brackets cast on to the joint yokes, the blocks facing each other on opposite sides of the tube. To each block is attached, by means of a double spiral spring, a gun metal casting, curved at the ends but flat in the centre. The springs are of sufficient strength to press the two castings together with a force of 6 pounds.

The cars used at Gravesend are supplied by the Falcon Engine and Car Works, Loughborough. The motors are run at 400 revolutions per minute, delivering at this speed, when the field magnets are fully excited, 15 h. p. on the brake. They were made by Messrs. Elwell-Parker, and the peculiarity of their shape is owing to the fact that they had to be made very narrow so as to fit under a car running on a 3 feet 6 inches gauge. The front of the motor is supported by two bearings on the driving shaft of the car, the rear being suspended by a spiral spring from the car body. A double helical pinion on the motor shaft drives directly a spur wheel on the car shaft, in the ratio of 1 to 4½.

The regulation of the motor is attained by massively-constructed switches mounted on each platform. One of these switches reverses the connections of the field so as to reverse the direction of the car; the other regulates the

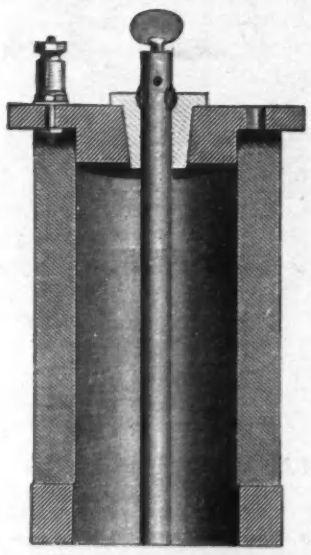


FIG. 2.—THE HOLTZER BATTERY.

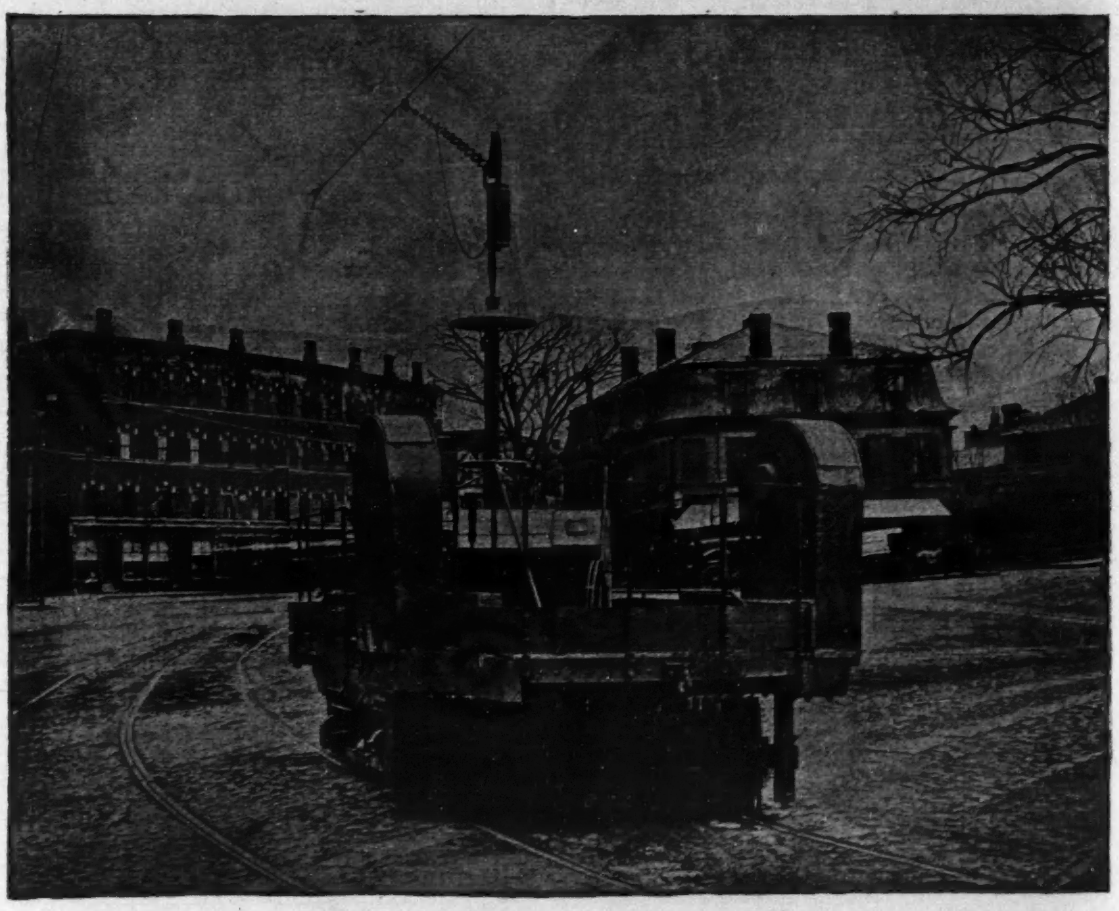
resistance of a shunt to the fields, so as to weaken or strengthen it, in proportion to the power required.

One of the cars is lighted electrically by means of low resistance lamps of the Bernstein make. The accumulator cells, each of 31 plates of the tramway type of the Electrical Power Storage Company, are inserted in the main circuit, and five lamps of 10 ampères each, and 6.5 volts, are run in parallel off the accumulators. The accumulators themselves, however, are not discharged; they only serve as potential reducers, the whole of the main current going through the lamps. Should one of the lamps break, the remainder are slightly more brightly incandesced, and the current due to the broken lamp passes through the accumulator. A two-way switch enables the accumulator to be taken in or out of the main circuit, and the accumulators are large enough to run all the lamps without assistance from the main current should it be requisite.

The Thomson-Houston Electric Railway Snow Broom.

One of the greatest troubles anticipated in connection with electric railways has been the encounter of the cars with heavy snow, whether in regular falls or in occasional drifts. In fact, there have not been wanting prophets of evil who predicted that the first heavy snow of the season would bury the electric roads forever. Such gloomy vaticinations, however, have proved false in the extreme, and the ingenuity of electrical engineers has been easily able to cope with the "beautiful snow."

With the object, however, of being prepared for the worst, in the usual New England winter, the Thomson-Houston Company designed a snow broom (shown in the accompanying cut) for use on the Cambridge Division of the West End Street Railway. The truck, which is of the Brill type and has a five-foot wheel base, is equipped with a 30 h. p. motor geared to drive the truck at a speed of 12 miles per hour. The snow broom is 30 inches in diameter and set at an angle of 45 degrees. It is driven by a stationary motor of 20 h. p. at a speed of 100 revolutions per minute. But two men are required to operate the broom, the brake and controlling mechanism being placed in such a position as to render it an easy matter.



THOMSON-HOUSTON ELECTRIC SNOW PLOW.

The broom was used for the first time Sunday, March 31, and gave perfect satisfaction. It was also tested by placing bricks and boards in front of it, and the way these were brushed aside to a distance of 4 or 5 feet from the track, leaves no doubt of the ability of this appliance to cope successfully with heavy storms. The company has also built a much larger machine, with 36-inch wheels and fitted with two brooms and a scraper, which will be able to deal with the most formidable impediments.

The Holtzer Cylinder Battery.

The desire to obtain an open circuit battery of large generating power and one which should quickly recuperate led to the construction of the Holtzer cylinder battery of the Leclanché type, by Messrs. Holtzer & Cabot, of Boston, and shown in perspective in Fig. 1 and in section in Fig. 2.

As will be seen on referring to the cuts, the battery consists practically of two parts only, as the cylinder, zinc and connector form the first part, they being collectively united and forming one piece alone; the second part being the glass jar.

The cylinder, resting on the top of the jar, forms by its weight a well-sealed joint, thus preventing evaporation.

There are no fragile parts to be easily broken, but one strong heavy carbon of cylindrical form, having a binding post well secured to it and thoroughly protected from salts. The zinc is separated from the cylinder by a porcelain piece of wedge shape to secure a close fit. Thus is presented one of the simplest and most practicable forms of Leclanché battery obtainable.

The Paris Meter Competition.

The competition of electric meters proposed by the Council of Paris for a prize of $2,000 and other amounts, of which mention has recently been made in these columns, will take place in June. The meters must be sent in closed packages, with an accompanying notice, between the 15th and 25th of May next, to the Bureau du Sous-Directeur des Travaux, Hotel de Ville, Paris. In return for the stipulated prizes the Council reserves the right to manufacture the meter selected, for use in the municipal central stations in Paris, without payment of further royalty. Full information can be obtained by addressing the Bureau de la Voie Publique et des Promenades, Hotel de Ville, Paris.

An Amphibious Motor.

To the Editor of The Electrical World:

SIR: An experiment was made recently at the factory of the Thomson-Houston Electric Company, at Lynn, which may interest some of your readers.

One of the company's ordinary motors was fitted with a new "water-proof" armature of most recent design, and while running with a difference of potential of 500 volts at the brushes, was doused with successive pails of water. Armature, commutator, brush holders, field and connection terminals received each a pail or two. The motor ran as quietly under such treatment as though accustomed to a daily bath. The ability of the motor to undergo this severe ordeal without sign of harmful results, is due to the fact that the armature was so wound as to give the greatest possible amount of insulation between points of great difference of potential, and to other special features of construction.

We are aware that it is not a new suggestion to submit motors or armatures to a hose stream, but no record exists, to our knowledge, of any instance in which this valuable suggestion has been applied in practice. The Thomson Houston Company boldly waded in, or rather its motor did, and the latter took so kindly to its bath that it has been proposed to make this experiment a standard exhibit and test at their factory.

MERLE J. WIGHTMAN.

Insulation of Dynamos and Circuits.

To the Editor of The Electrical World:

SIR: Would you answer the following question in THE ELECTRICAL WORLD, as I think it would interest other readers besides myself? If dynamos are properly insulated at the station from the earth so that there is no ground connection electrically, would there be as much, or any, danger to a person coming in contact with the electric light wires, and would it be necessary to use insulated wires? C. A. M.

MONTREAL, Can.

ANSWER.—It is both necessary and desirable to maintain the dynamos free from grounds. But even when so insulated danger may exist in coming in contact with electric light wires due to grounds which may exist on the line. For this reason the circuits also should be insulated as perfectly as possible with the best insulated wire.—EDS. E. W.

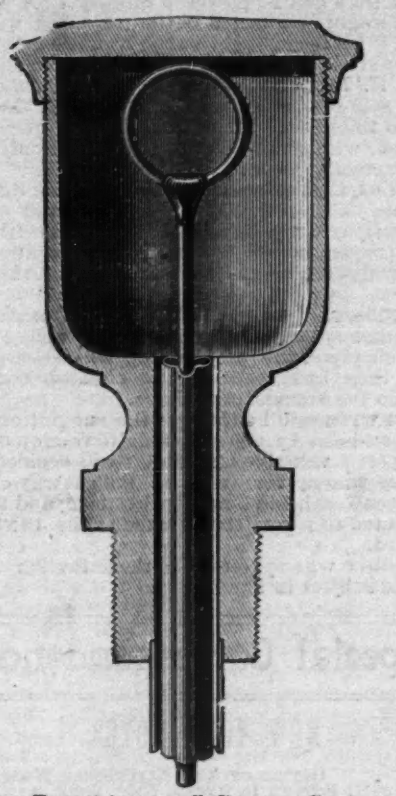
The "Albany" Grease Cup.

The accompanying illustration represents the novel grease cup made by the Albany Lubricating Compound and Cup Company, of this city, designed to hold the well-known lubricating compound of that company. The cup is made of glass or made solid of cast brass, the cover screwing down firmly upon it. Passing down through the centre of the cup is a copper rod, having a ring at the top, which conducts the heat from the revolving shaft to the compound, which it gradually melts. As it runs down it is guided by the rod, and passes through a triangular grooved trough, and is led directly to the shaft. These cups are made with spring catch coverings, having a spring at the top. Those with screw covers are specially designed for dynamos and other high-speed machinery. They are in use in all the stations of the United States Illuminating Company in this city, and the Ball Electric Light Company also have this style of cup and lubricating compound in extensive use.

The "Climax" Damper Regulator.

Smoothness of running, as well as economy, in electric light stations, requires the maintenance of a constant boiler pressure. To secure this desirable end, automatic damper regulators are being introduced, and with good results, as they relieve the fireman of a constant but unnecessary strain, and allow him to devote more time to maintaining his fires in good condition.

Our illustration represents the "Climax" damper regulator manufactured by Mr. Timothy Kieley, of this city,

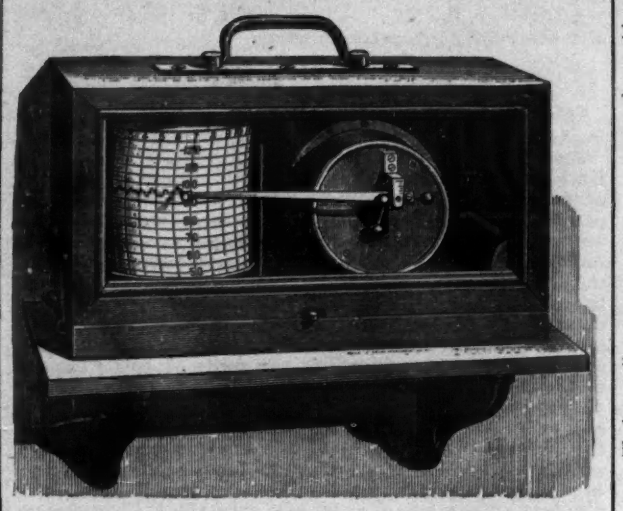


THE "ALBANY" GREASE CUP.

and its operation will be readily understood. The lower diaphragm, upon which the boiler pressure constantly acts, is forced up when the desired pressure is reached, which movement is conveyed to the valve, causing it to open the inlet-port and thereby force the small or upper diaphragm out. This causes the small or upper lever to which the damper in the flue is connected to go up, which motion closes the damper. In this position the small lever will remain until a slight reduction takes place in the boiler pressure, immediately upon which the motion of the lower lever is reversed, allowing the spring which acts against the lower lever to reverse the motion of the valve, and thereby close the inlet-port and at the same time open the exhaust-port, allowing the water that caused the small diaphragm to move out to escape, and a reverse motion of the small lever to take place whereby the damper in the flue is again opened. This operation is repeated as often as occasion requires, and as a consequence the steam pressure is kept constant and fuel is economized.

The Richard Registering Voltmeters and Ammeters.

For the economical working of a central electric light station, it is very important to obtain a record of the output during the whole time the station is at work, and this may be done by looking up indications of ammeters and voltmeters at stated intervals, or, better still, by letting these instruments write their own record. MM. Richard, the well known makers of registering meteorological instruments of Paris, have recently brought out a set of registering ammeters and voltmeters, and some of these instruments are now in use at the new Edison Station in the Palais Royale, and have previously been installed at the Central Station at Pau. We illustrate in the above engraving, taken from *Industries*, the registering voltmeter used at the Palais Royale. The indicating portion of the instrument is an ordinary voltmeter of the Hummel type, the pointer of which is provided with a pencil tracing a line on a strip of paper mounted upon a metal cylinder, which is slowly revolved by clock work. The superintending engineer, by the inspection of the paper as it is delivered to him by the attendant at stated times, can thus see at a glance whether the proper pressure has been maintained during his absence, and it is interesting to note that any deviation from the normal



THE RICHARD REGISTERING VOLTMETER.

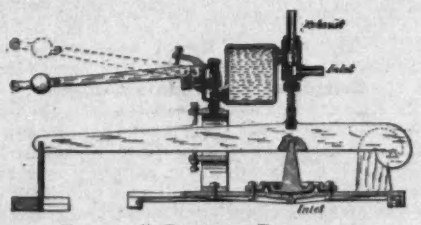
pressure is found to correspond in point of time with variations in the steam pressure, a registering steam gauge being also in use at the station. MM. Richard, the makers, claim that their registering voltmeter indicates as small as 1 or 2 per cent. of the normal pressure.

The "Water-Tube" Feed Water Heater and Purifier.

Our illustration shows in part section a new water tube feed water heater and purifier, made by the Goubert Manufacturing Company of this city. It has been designed especially to be used in connection with high speed engines such as are employed in electric light and power plants, for which purpose the area for the passage of the steam between the tubes has been made very large so as to avoid back pressure. The tubes are of brass and free to expand, and as the pressure is on the inside there is no possibility of their collapsing, and by the construction adopted, also, leaking at the ends is entirely obviated. The area for the passage of the steam between the tubes is from eight to sixteen times as great as that of the exhaust pipe, for which reason there is no back pressure, as above stated. Another advantage possessed by the heater is that by the removal of the head, the tubes can be cleaned. Ample provisions are embodied in the heater for the separation of scum and sediment, and, being made entirely of cast iron and brass, it does not pit or corrode. These heaters are already in use in a number of electric light stations.

Influence of State of Aggregation on Electrical Resistance.

It was pointed out long ago by Clausius that according to the results of Arndtsen's researches on the electrical resistance of metals, the resistance of a simple metal in the solid state is directly proportional to the absolute temperature. This was subsequently confirmed by Werner Siemens, with the limitation that it does not hold good for temperatures near the melting point of the metal. Grunmach, in a recent number of *Wiedemann's Annalen*, describes some experiments from which it appears that the variation in the resistance of pure mercury does not obey this law even at temperatures much below the melting point. He finds that the temperature coefficient be-



"CLIMAX" DAMPER REGULATOR.

tween 40 and 90 diminishes steadily with the temperature, as shown by the accompanying table:

Temperature.	Temperature coefficient.
—40° to —50°	0.00226
—50° to —60°	0.00134
—60° to —70°	0.00111
—70° to —80°	0.00078
—80° to —90°	0.00037

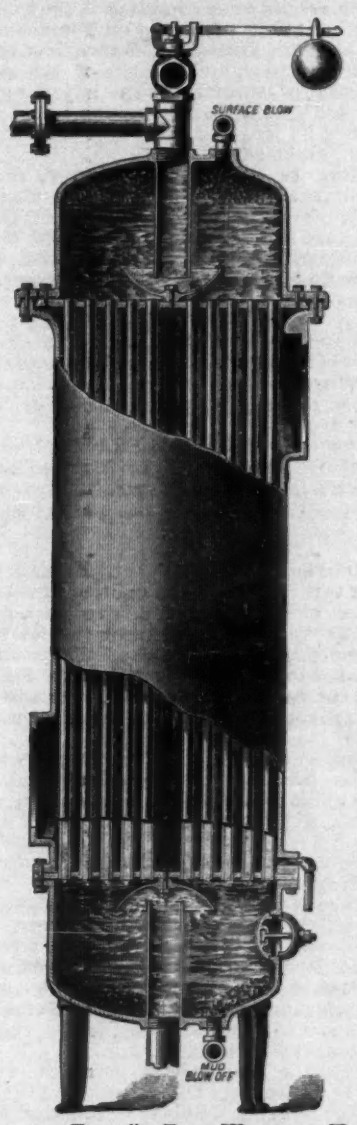
For fluid mercury he obtains the temperature coefficient 0.00086, which is in fair agreement with Werner Siemens' value 0.00095, and the value 0.000882 obtained by Mascart, Neville and Benoît. According to Grunmach, the resistance during liquefaction only increases to about 1.5 times its original value, a much smaller increase than Cailletet and Bouty and C. L. Weber have given as the result of their investigations.

Output of Electro-Metallurgical Works.

The following table shows in tabulated form the output and rate of working of various electro-metallurgical works. This table, taken from the *Berg- und Hüttenmännische Zeitung*, does not include some very large works in this country:

No.	Current. Volts.	Current. Amperes.	No. of baths in series.	Area of cathode in square meters per bath.	Current density per square meter per bath.	Deposit in 24 hours. Pounds.	Deposit per hour and h. p. Pounds.
1	2	1,000	12	35.0	30	661	3.5
2	15	240	50	8.0	30	672	3.9
3	2	120	6	2.4	50	44	.....
4	25	240	49	5.6	43	745	.....
5	15	240	12	8.0	30	.....	.....
6	15	240	40	12.0	20	458	3.9
7	30	120	80	6.0	20	458	3.9
8	3	1,000	12	35.0	30	661	3.3
9	15	240	48	3.4	70	714	..
10	4	700	20	21.1	31	881	4.5
11	8	300	40	22.5	13	551	4.5
12	27	300	120	15.0	20	1,984	6.8
13	3	1,000	48	51.0	20	220	0.7
14	15	240	8	....	..	112	..

The numbers refer to the following works: Copper works. 1. Oker, old practice, dynamo Siemens C_1, 7 to 8 h. p.; 2. Oker, present practice, dynamo Siemens C_{18}, F_8,



THE "WATER TUBE" FEED-WATER HEATER AND PURIFIER.

H_7, 6 to 8 h. p.; 3. Stefanshütte, former practice, dynamo Siemens C_6; 4. Stefanshütte, present practice, dynamo Siemens H_7; 5. Casarza, dynamo Siemens C_{18}, 6 to 8 h. p.; 6. Königshütte, dynamo Siemens C_{18}, 6 h. p.; 7. Wittkowitz, dynamo Siemens C_{18}, 6 h p.; 8. Moabit, dynamo Siemens$_1$, 7 to 8 h. p.; 9. Birmingham, dynamo Wilde; 10. Blache St. Waast, Pas de Calais, dynamo Gramme, 8 h. p.; 11. Marseilles, dynamo Gramme No. 1, 12 h. p.; 12. Hamburg, dynamo Gramme, 12 h. p.; 13. Lead works in New York, dynamo Weston, 4 h. p.; 14. Tin works, locality not given, dynamo Siemens C_{18}, 7 h. p.

Details of Telephone Construction.

To the Editor of The Electrical World:

SIR: Will you kindly answer the following questions: 1. What is the size of the magnet in the Bell receiver? 2. What is the size of the wire used in the coil? 3. How is the induction coil used in the Blake transmitter constructed? H. M. A.

BROOKLYN, N. Y.

ANSWER.—The magnet of the telephone receiver is a compound one, built up of four separate steel bars, 8¼ inches long, ¾ inch wide and ⅛ inch thick. 2. The wire used in the coil of the telephone or helix, is No. 32 B. W. G., silk covered, wound to a resistance of 80 ohms. 3. The induction coil is wound to 2½ ohms of No. 19 B. W. G. wire for the primary, and 260 ohms of No. 32 B. W. G. wire for the secondary. The primary coil is wound to the right and the secondary to the left or one reversely to the other.—EDS. E. W.

City Mayors on Electric Street Railways.

During the recent discussion over the adoption of the electric system in one of the Southern cities, the question naturally arose in regard to the successful operation of the electric system in other cities where it was being used. In order to get an impartial judgment upon this question a telegram of the following nature was sent to the different mayors of the cities which were then operating electrical railways on the Sprague electric system: "Is the Sprague electric motor with overhead wires in successful operation in your city? Is it safe and satisfactory? Answer at my expense." This telegram was sent to the Mayors of Cleveland, O., Akron, O., Carbondale, Pa., Wilkesbarre, Pa., Boston, Mass., Wilmington, Del., Harrisburg, Pa., Richmond, Va., St. Joseph, Mo., Hartford, Conn. The replies were unanimous in their approval and indorsement of the system, such as: "Our people are much pleased with it;" "entirely safe and satisfactory;" "safe and successful and satisfactory here;" "successful and very satisfactory;" "the electric road gives great satisfaction."

The Western Electric Company's New Building.

The new building of the Western Electric Company at the corner of Greenwich and Thames streets, this city, affords an example not only of the immense growth of the company's business, but of the thoroughness with which improvements in construction and appliances are made to meet the requirements of the modern factory. The exterior, which is of buff brick and terra cotta, presents a handsome and solid appearance, and its interior arrangements are about as complete as they can be made. The building has 119 feet frontage on Thames street and 83 frontage on Greenwich street. The work of erection was begun in May last year, and in spite of the delay caused by the necessity of shoring up the adjoining buildings, it was ready for the roof beams by the 1st of November. It was designed by Mr. Otto Eidlitz, of the firm of Marc Eidlitz & Son, builders.

The building is practically fire-proof, the columns, girders and beams being of iron, and the floors of brick and concrete, covered with a layer of maple; the stairways and elevators are separated from the rest of the building by brick walls and iron doors. There is also a fire-proof vault on each floor for special storage purposes.

The shop entrance and the platform for receiving and shipping goods are on Greenwich street, and the entrance to the offices and the retail store is on Thames street. In the basement is the steam plant, which consists of three Babcock & Wilcox boilers, two in battery, capable of developing 312 h. p., and a separate boiler capable of developing 136 h. p.

Its power plant consists of two Russell automatic cut off engines capable of developing 175 h. p. each, and a 35 h. p. engine with 8 inch cylinder and 12 inch stroke. An interesting feature in the transmission of power is the use of raw hide leather rope belting furnished by the Link Belt Machinery Company of Chicago. From the driving wheel of the engine on the first floor to the main shaft on the second floor this rope belt is in one continuous strand of 8 convolutions, one of which is run over a special stretcher to take out the "sag." From the main shaft on the second floor, one continuous strand of the raw hide leather rope belt is used to transmit power to the 8 floors above. There are 12 convolutions of this rope belt to the fourth floor and one convolution less to each succeeding floor above.

In the equipment of the engine room every modern improvement has been brought into requisition. The heating of the building is effected by a heating chamber in the basement, a blower, 10 feet by 5, and a Sturtevant engine. A duct conveys the cold air from the roof to the heating chamber, whence it is blown through a hot-air duct to openings on the various floors.

The elevator service is excellent, there being two elevators for freight and one for passengers. The front basement has a blacksmith shop and a foundry, and on the second floor are the nickel plating room, the retail store, the electric housework department and the cable department store room. To the left of the Greenwich street entrance is the plating room, under the control of J. Mercil, general nickel plater.

On the left of the Thames street entrance, is the dynamo room, where there are three 45 light and one 35 light arc dynamos, and a 300 light incandescent dynamo of the Western Electric Company's make for lighting purposes, all run by cotton leather belting furnished by A. B. Laurence. The current is carried by Western Electric Company's cables to each floor, and is transmitted to the lamps by okonite wires aggregating nearly two miles in length. The arcs are controlled by the special regulator of the company. There is a large rheostat box, to cut in or out for each floor, run in connection with an ampère indicator for the incandescent system. There is also on this second floor an admirable arrangement of Hill clutches on the main shaft by which either of the Russell engines in the basement can be used for power and light.

The third floor is occupied by the battery room and chemical laboratory, planing mills, wood-working machinery, etc., joinering and cabinet making. The fourth floor is devoted to store rooms, packing and shipping rooms. The fifth floor is used for metal working, and carries a number of presses, screw machines, planers, engine lathes, etc., and here are also the shop office and the shop storeroom. General manufacturing is carried on on the sixth, seventh and eighth floors. The ninth floor is occupied by the manufacture of telephones, testing and the storing of goods prior to shipment.

On the tenth floor are the winding room, the work room for the switch-board department, and the offices for the New York branch of the company. There are three water tanks on the roof under electric control from the engine and boiler rooms. As soon as a tank becomes full of water the fact is noted by an annunciator. It also starts bells ringing which continue to sound until the engineer or fireman shuts off the flow to the tank indicated.

The telephone arrangements are very complete, the various offices and floors being connected by the Western Electric speaking tube telephone system which enables connection to be instantly made between one room and another without the aid of a "central" or switch-board. In the waiting room of the general office are also three telephone closets, one of which is for the speaking tube telephone, while in each of the other two is a long-distance set and a metallic circuit city telephone.

A library is to be fitted up which will contain a complete collection of standard works and current literature, for the use of the employés.

The offices of the manager, Mr. H. B. Thayer, the president, Mr. E. M. Barton, and the secretary and treasurer, Mr. J. M. Jackson, command a fine view of the city and the surrounding country, and the rest of the offices are not less light and airy, commodious and handsome. They are occupied by Mr. Thayer's assistant, Mr. A. L. Salt; Mr. I. Loveridge, the purchasing agent; Mr. A. T. Wells, of the switch and cable department; Mr. J. J. Carty and the other members of the staff.

Altogether, the building is a credit to its enterprising and deservedly prosperous owners.

Sale of the Elieson Electric Company in England.

An important sale takes place on April 17 at the Plashet Hall Works, Rumford Road, Stratford, London, England, of the property of the well-known Elieson Electric Company, Limited. The plant includes the model generating and tram car station, with its complete equipment of motor cars, engines, machinery, storage batteries, motors, etc., as well as the British, foreign and colonial patents of the concern. The Elieson system has already been described in our columns. It has been elaborated by the work of Mr. Elieson and the company supporting him, but the series of costly experiments involved, extending over four years, during which time the motors of the company ran nearly 50,000 miles and carried 400,000 passengers, appear to have exhausted the means at the disposal of the company, so that they were unable to meet the demands for the extensions necessary; and hence it has been decided to place the entire property of the company on sale. In the Elieson system the motor itself revolves, being supported on a vertical shaft, to which it is attached by its own framework. It carries with it a crown or bevel wheel, which drives the right or left hand bevel wheel on the car axle at will, and thus direct driving is obtained. Each right or left hand wheel on the car axle engages by a sliding clutch, and thus by a simple movement of the end of the lever the car is driven backwards or forwards. In connection with this novel motor and gearing is used the Elieson accumulator, the peculiarity of which is that the squares in the grid are filled in with spiral coils of thin lead and asbestos. Of this battery Prof. W. D. Marks, of Philadelphia, reported that it was unrivaled for efficiency, and as to durability in practice was the most promising that he had seen. Professor Perry, of London, also reported on it as especially adapted for tram-car work, being a great improvement on those in general use. The plant includes, in addition to the Elieson motor and storage batteries, a Marshall engine, a Richmond engine, six Crompton dynamos, a Phœnix and a Jarman. This important sale is in the hands of Wheatley Kirk, Price and Goulty.

The Board of Electrical Control Investigating Gas Explosions.

Mayor Grant invited the representatives of the city gas companies to assist him on Monday last in an investigation into the cause of the recent gas explosions in the subway in front of Fifth Avenue Hotel and in organizing preventive measures for the future. There was a large gathering of gas men, among whom were J. P. Kennedy, of the Mutual Gas Company; Gen. Francis B. Spinola, of the Standard Gas Company; W. H. Bradley, of the Consolidated Gas Company, and E. J. Enfer and E. Lalor, of the Equitable Gas Company, besides a good number of representatives of electrical companies interested in the investigation.

Mr. LAUTERBACH, of the Consolidated Telegraph and Electrical Subway Company, stated that the leakage of gas was often owing to rotten pipes, although in this particular instance the escape of gas into the basement of the Fifth Avenue Hotel was caused by an employé of the Standard Gas Company leaving a cap off a main. In the matter of inferior quality of pipes, and want of care in laying down, the Standard Company were an exception. Their mains were not only properly laid down but were of first-class materials and construction. He did not consider that the theory of spontaneous combustion was involved in this explosion; neither could it be accounted for on the supposition that there had been an electric spark in the subway, for there was no current on the wires at the time of the explosion. The most feasible explanation that presented itself seemed to be that the gas passed into the electric duct which ran into the basement of the hotel, where it came in contact with a fire on which a workman was melting a glue pot. The flame, without being noticed by him, could ignite the gas, travel back through the duct to the subway and there cause the explosion. The leakage of gas was very great, being 20 per cent. in the older parts of the city, and 15 per cent. in the new districts. The constant use of blowers at the manholes of the subway had to be resorted to to prevent as far as possible the dangerous accumulation of gas.

Mr. J. P. KENNEDY, President of the Mutual Gas Company, took exception to the statement that the pipes were rotten and badly laid. That was quite at variance with his experience as a gas engineer, ranging over 30 years. It was impossible to prevent leakage, but they did not look for a loss of more than 5 per cent. from that cause. It was a mistake to suppose that the gas got into the basements and cellars and sewers, for there could be no lateral pressure from illuminating gas which always worked its way upward.

Mr. LOWBER SMITH, the Commissioner of Public Works, asked Mr. Kennedy if he was aware that there was a sewer manhole near the Grand Central Depot, from which gas can be drawn by a stop-cock, and will burn several minutes with a flame reaching 10 or 15 feet high.

Mr. KENNEDY thought that steps should be taken to keep the gas out of the subways, and this could be done by coating them with asphalt cement; this would be more efficacious than coating the gas mains with cement to keep the gas in. He thought the subways could be ventilated by pipes put in at different levels. From his point of view the company's pipes were property on which they paid taxes. If their gas escaped it was their loss, and on the owners of property which might possibly be injured by the escaping gas devolved the responsibility of protecting themselves against it.

Mr. BECKWITH considered Mr. Kennedy's suggestion as to the ventilation of the subways of no practical value.

The meeting adjourned to the following day. The investigation was resumed on Tuesday at 1 o'clock.

Commissioner GIBBENS said he had read in the *Evening Post* a statement from the Edison Electric Light Company to the effect that it had had no trouble from leakage of gas and had had no explosions in any of its conduits or man-holes, and he asked Dr. Wheeler, who was formerly in the employ of the Edison Electric Light Company, whether he could substantiate the statement. Dr. Wheeler said it was inaccurate; there had been a number of explosions in the man-holes of the company and on one occasion a man-hole was blown from the street to the roof of a house.

Mr. C. C. JACKSON, of the Westinghouse Electric Company, gave some of his experience with natural gas in Pittsburgh. They had found there that the pipes should be of wrought iron, and they used auxiliary joints. Over the joints were globe covers, which were ventilated by pipes carried up to the surface of the street. Since adopting this plan they had no explosions, and as to leakage if they lost one-half of one per cent. they wanted to know the reason why. Formerly they had somewhat lively times. The gas used to get into the cellars, and three or four houses were blown up.

President ANDREWS, of the Steam Heating Company, wished to correct a popular impression. He said the public thought that the explosions were sometimes caused by the steam in the pipes. This was quite a mistake; it could not be. If there was any exploding to be done, it was done before the steam left the station. Five years ago there were gas explosions before there were any subways. He suggested that ventilation was the proper remedy and that holes be made in the covers of the man-holes.

Mr. BECKWITH opposed this on the ground of danger of ignition from matches, etc.

Commissioner SMITH said a great deal might be done if fuller powers were given to the Commissioner of Public Works. His department saw certain things going on which they knew were inimical to the interests of the public, but they had no power to interfere. A great improvement might be effected if the gas pipes were made tight, and if his department were given the power to do so they would see that the pipes were tight when laid.

Mr. W. H. BRADLEY, engineer of the Consolidated Gas Company, said it was impossible to prevent the leakage of gas from the pipes. This statement was questioned by Mr. Jackson, who showed that it was not only possible but was practically done.

Mr. BAYLES, Commissioner of Health, said that the gas leaking into the soil, unless excessive in quantity, was not seriously injurious to the public health. It had antiseptic properties which were favorable to the destruction of any disease germs that might be lurking in the sub-soil.

Mr. FLANNERY, of the Standard Gas Company, stated that his company had bestowed great care on the construction of their pipes, the majority of which were of cast-iron, and they had been able to effect a considerable reduction in the amount of leakage.

Mr. BECKWITH said he thought the suggestion to ventilate the man-holes by pipes running to the top of an electric light post a valuable one; and it was decided to make such an experiment forthwith in the subway on Broadway, between Tenth and Fourteenth streets; and the expert was instructed to report on the same at the next meeting of the board.

A committee was appointed to make further investigations on the subject in hand.

Special Correspondence.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
165-177 POTTER BUILDING, NEW YORK, April 8, 1889.

The Universal Automatic Lubricating Company have offices in the Welles Building, 18 and 20 Broadway, this city. They manufacture and sell the automatic lubricator which is now being used on every one of the leading railways of the country, and is specially recommended for electric railway service. Mr. L. S. Hegent is the president of the company and Mr. L. H. Southwick the treasurer.

The Vulcanized Fibre Company, of Wilmington, Del., with New York offices at 14 Dey street, are manufacturers of hard and flexible vulcanized fibre for general mechanical purposes, and especially for electrical insulation. This fibre can be used in a great many places where other materials are not admissible, and it is to be found on the apparatus of all the leading companies, in their dynamos, switch-boards, plugs, magnet heads, lamps and a variety of other apparatus, including telegraph, telephone, burglar and fire alarm service.

Hine & Robertson were made sales agents, last week, for the Champion Flue Scraping Company. They describe the apparatus as a "rattling good one," which has met with much favor. It is stated that with this scraper, in using from 50 to 100 bushels of coal a day, at least 25 bushels a week can be saved. The Champion flue scraper in passing through the flue will cut away all the incrusted formation, and leave nothing but the iron. It is claimed also that it will remove all scale formation in water-flue boilers such as the Heine, Babcock and Root.

The Excelsior System.—I hear from the Excelsior Company that Mr. F. W. Horne, their Western representative, closed a contract on April 3, with the authorities of St. Joseph, Mo., for a large city plant, which is to be put in immediately. The company have just shipped a 150-light arc plant to Duluth, Minn. They report an exceedingly brisk demand for their new apparatus, which you illustrated last week. They have just shipped two 10 h. p. motors to Belfast, Me.; one 10 h. p. to Camden, Me., and one 1 h. p. to Bath, Me. They have one of 10 h. p. in the Casino, Brooklyn, for running the coasters on the toboggan slide. They have sent to Texas three of 5 h. p., two of 3 h. p. and three of 2 h. p., all of which indicates high appreciation of a good motor.

Zimdars & Hunt, 234 Mercer street, are the sole patentees and manufacturers of the Zimdars pneumatic system of bells and annunciators for hotels, residences, public buildings, elevators offices, steamships, etc. The push button in this system contains a small rubber ball or air holder, connecting with a bell or annunciator by means of a lead pipe, so small as to resemble an electric light wire, which can be bent around corners or pushed through a small hole in the floor or walls as easily as an ordinary bent wire. The electrical supply dealers and retail electricians very often have calls for these things, and have put in a great many of them in

various parts of the country. The firm carry on a large business, as exemplified by their handsome catalogue of 32 pages, which they will be glad to send on application.

Pierce & Thomas, 42 Cortlandt street, report an earnest inquiry in regard to their new compound high-speed engines. They are now shipping two 50 h. p. automatic high-speed engines and 100 h. p. boilers, pumps, etc., for a complete steam plant to be put in at Bogota, U. S. Colombia, where the Thomson-Houston Company are installing a 1,000 light plant. They are building a 250 h. p. double compound condensing Corliss engine, for use by the United States Government in the navy yard at San Francisco harbor; also a 300 h. p. Corliss engine for a cement mill in Pennsylvania, and they are now erecting a 150 h. p. steam plant complete, with engines, boilers, rollers, rock crushers, etc., for use in one of the new Edison plants for concentrating iron ore in Pennsylvania. Their plant of 50 h. p. at Perth Amboy, N. J., in connection with the Edison system there, was started last Monday most successfully.

Hine & Robertson, 45 Cortlandt street, have put in a 14-inch "eliminator," extracting the oil from the exhaust of six engines, in the Western Electric Company's new building at Greenwich and Thames streets. They have sold nearly 200 of these eliminators within one year, the majority of which were sent out on approval and were accepted after a thorough test. Of the Kellar damper regulator 1,000 are now in use, a great many of them being employed in connection with electric plants. These regulators maintain in the boiler an absolutely uniform pressure, furnishing steam at a steady pressure to the engine and securing a perfect light. Their new catalogue has just been issued in an attractive shape, and it includes many excellent steam appliances that should be included in the equipments of electrical plants. They would be glad to send it to any of your readers on application.

Supplying Motors.—I hear a good many complaints from the representatives of the electric light and motor companies, of this city, as to the conditions by which they are unable to extend the motor service. The fact is that the new industry is discouraged owing to the obstructions placed in the way of hard working agents, who do not care to put in a week selling a motor, and then to find that they are not allowed to connect it even with circuits which are already in existence. The subway commissioners can hardly understand the hardships that they inflict in this matter, or I do not believe they would allow the extension of the motor business to be thus interfered with. I know of one instance in which a poor man manufacturing in a small way took a store near Fourteenth street, at a point where there are no conduits, and bought a motor. He has been unable to do anything for two months past, and is subject to a loss which he can ill stand. There is not the slightest reason in this case or in many others like it why permission to make connection with existing circuits should not be granted.

Ozokerite.—A great deal of attention is being paid in commercial circles to the recent discovery of ozokerite in the mountains of Utah, for the development of which a company with a capital stock of $1,250,000 has been formed by Mr. Jacob Wallace, of the Stewart building. Hitherto this mineral wax has generally been believed to exist only in Galicia, Austria, whence American supplies have been obtained, but there seems no doubt that Utah will now furnish this country with all that can be needed. As a rival to bees' wax, ozokerite has already reduced the price of that product from 40 to 25 per cent. a pound and the reduction is going on. The melting point of ozokerite is as high as from 155 to 190 degrees Fahrenheit. It is plastic without being soft, and hard without being brittle. The strongest acids make no impression on it, and the leading electric companies have already discovered its great value as an insulating material for wires and cables. There are a great many uses to which the substance can be applied, but I believe that as an insulating material it is destined to enjoy a great and lasting popularity.

T. F. Hunter & Co. and the Eddy Electric Light Company, represented by Willis & Hunter, have moved to 33 Church street. Mr. Hunter informs me that his business has increased in the past year over 100 per cent. The firm is now carrying a full line of electrical supplies. Among the novelties may be mentioned the Paiste switch, of which the sales are large and increasing. The Heath speed indicator, which has been illustrated in your columns, is also in great demand. It seems to have become quite a practice, they say, to coat insulated wires and cables with the P. & B. paint compound, and to apply it to construction and material wherever possible for increasing the insulating properties. P. & B. insulated electric wires and cables are also booming, and large orders are being received for lengths of 3, 4 and 4½ miles of numbers from 4 to 16, B. & S. gauge. The firm are also headquarters for the Clark rubber-covered wires and cables. They report their February sales double those of any previous month. Between 20,000 and 30,000 feet of Clark wire is now in use in the new Tower building, 50 Broadway, put in by Buehler & Bateman, and nearly 20,000 feet is being put in the new building at Broadway and John street, by the Electric Construction and Supply Company. In the battery line they report the sale of 1,500 Diamond carbon cells in February, and the demand is still active. The call for Eddy motors is also very brisk and growing.

W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
Room 8, Cook Building, cor. Franklin and Congress Sts.
BOSTON, April 8, 1889.

Personal.—Mr. Edward Weston, of Newark, N. J., and Messrs. H. McL. Harding and Clarence E. Stump, of New York, were among the electrical fraternity who visited Boston last week.

Pettingell, Andrews & Company, of Boston, have established a Western agency at Chicago. The senior member of the firm has gone to the last-named city to perfect all the initial arrangements for starting up the new enterprise.

The Greene & Wood Manufacturing Company, of New Bedford, Mass., who supply electrical woodenware, have secured the services, as treasurer and manager, of Mr. L. C. Bass, lately manager of the Woonsocket Spool and Bobbin Company.

Grant, Pearson & Co., of Boston, have just concluded arrangements for shipping a complete steam plant of 200 h. p. for electric lighting in Cuba. McIntosh, Seymour & Co.'s engines of 125 and 70 h. p. capacity will be used for this installation.

The Mason Regulator Company, of Boston, has removed its offices from No. 22 to No. 10 Central street. This company will soon have its new factory at Milton, Mass., ready for putting in the equipment of new machinery; and it is thought that everything will be in readiness to start up about June 1, 1889.

Boston Electric Club.—Dr. Arthur de Bausset delivered an address upon "Aerial Navigation," at the rooms of the Electric Club, Saturday evening (April 6, 1889), at a quarter before 8 o'clock. Dr. de Bausset is the inventor of the only system of aerial navigation which has ever been looked upon favorably by the United States Government.

A. L. Russell.—This well-known electrician, familiar to most of the electrical fraternity as the successor to Mr. Chas. Williams, Jr., has enjoyed a very satisfactory business at his new quarters, No. 100 Sudbury Street, Boston; and the prospect is encouraging for a steady increase in the already large number of his customers. Telegraph and all other kinds of electrical instruments are Mr. Russell's specialties.

The Jarvis Engineering Company, of Boston, are very busy filling orders constantly coming in. Within a fortnight the following shipments were made, viz.: Four boilers (set with Jarvis patent furnace and Sheffield grate) to New Bedford Gas Light Company; a 200 h. p. Armington & Sims engine to the North Shore Electric Light Company, Revere, Mass.; 80 h. p. Armington & Sims engine to Whitman Electric Light Company, and another engine of the same make to the Thomson-Houston International Electric Company for export.

A Deserved Compliment.—The following is a clipping from a recent issue of the Boston *Evening Record*: "J. R. Magee, the agent for the isolated lighting department of the Thomson-Houston Company, occupies one of the most luxurious and pleasant offices in town. His office is on the first floor of the building 620 Atlantic avenue, and above are the offices of the other departments. Of course, the main feature is the number of electric lights, and when they are all glaring under their variegated globes the effect produced is most agreeable. The private office is a miracle of luxury. Rich hangings and tapestries, plate glass mirrors and rare works of art adorn the walls, and everywhere the electric lights shed their soft beams. All the fixtures are fac similes of famous specimens of English handiwork, and were imported at great expense. One of them is the exact counterpart of one in the Princess of Wales' boudoir. Mr. Magee is the enterprising man who secured the contract for lighting the Pension Building for the Inauguration Ball. He secured the contract by hard work and low figures and took his machinery and fixtures from Boston. Every one supposed he had lost money, but instead he made a handsome profit. He told me that he would have been satisfied even if he had been out of pocket, for the advertising he received fully recompensed him. Mr. Magee lives at Melrose, is a young man, and possesses in a remarkable degree the faculty of getting there."

W. I. B.

PHILADELPHIA NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
31 City Trust Building, Philadelphia, Pa., April 8, 1889.

Messrs. Jno. W. Shaw & Co., successors to Shaw & Geary, are getting out a new catalogue of the popular line of goods manufactured by them, which can be had upon application at their offices, Nos. 52 and 55 North Seventh street.

Westinghouse Interests.—The interests of the Westinghouse Electric Company and its adjunct corporations in this city have been placed under the charge of Messrs. C. H. Bragg and C. H. Cole, who will contract for all isolated work and supervise its erection. The local company, styled the Keystone Electric Light and Power Company, will still be controlled by Messrs. R. Muckle, Jr., & Co. The change went into effect last week.

The Atlantic City Road.—The new overhead system electric railway, which is in process of construction at Atlantic City, N. J., by the Pennsylvania Railroad, is being pushed to a rapid completion. Six cars have already been delivered at the station, and last week the fine Edison dynamo which is to furnish the current was placed in position. It is the intention of the company to get everything in smooth running order before the opening of the season, which is usually between the 20th of May and the 15th of June. Atlantic avenue, on which the road will run, will be lighted its entire length by incandescent lamps which will probably be furnished free by the company.

Marine Lighting.—The large steamboat "Republic," which plies between this city and Cape May, has just been fitted up with 200 incandescent lamps of the Westinghouse direct system. The steamer "Eastern Shore," a companion vessel to the "Tangier," mentioned previously, will be lighted during the coming season with 125 lights, working off direct current, and will also carry a 4,000 c. p. search light. That antique side-wheeler, "Sylvan Dell," which has traversed the waters around New York since the time "when the mind of man runneth not to the contrary," has been placed on the Delaware River for service, and has been fitted up with 50 incandescent lamps of the Westinghouse direct system.

Monster Driving Belts.—The belts used to connect the large dynamos in the new Edison Central Station, on Sansome street, to the engines, are over 50 feet in length and 39 inches wide. These mammoth circlets of leather were especially made for this work by Messrs. C. W. Henry & Son, of No. 228 North Third street, this city. As the engines are directly under the generators, the driving belts can have no sag or loose play, and the work of attaching them was delicately judged and so neatly done that there is not the least swaying motion while the machines are at work. The Messrs. Henry have a new belt, composed of layers of strong duck and best oak tanned leather, hand stretched, which was devised especially to prevent any stretching after once in service.

The Electric Car Company of America had another trial of its new car operated with storage batteries, on the 30th ult., which was very successful. The car ran smoothly, without any jar upon starting and stopping, and was backed quickly and smoothly. At one juncture of the run, while a test of backing the car was being made, an open switch caused it to stray from the track. But even with this there was little cessation of speed, and the car was run ahead over the paving stones until it regained the track at the point of leaving it. There was quite a party on board, including President Iselin, of the Gibson Storage Battery Company; Mr. Gibson, Mr. J. Engle Cochran, of Chester; Mr. H. C. Howard, of Media; State Senator Woolverton and Messrs. Davis and Abercrombie, all of Sunbury, Pa.; Dr. Girdner, of New York; Mr. E. P. Stratton, vice-president of the Flushing & College Point railway, who with Messrs. Thomas Elliott and C. Frey, of the same company, have been investigating electric railway systems with a view of adopting it on their line of road; Mr. Rudolph M. Hunter and Mr. George H. Condict. A private trial was held on Saturday, when a 20-mile run to Germantown and return was made.

State of Trade.—In the matter of electrical progress, Philadelphia is probably as far advanced as any city on this continent, and the interest now being shown in electrical matters is indicative that the local dealers and constructors are determined that their city shall keep her position. While it is probably true that more business could be done than is now being accomplished, still the prospects are that the season just opening will be the most fruitful of any yet experienced and plans are being laid accordingly. One of the oldest houses in this city report the amount of work outlined for this year to be very large. They claim that not only have their hands been kept busy during the winter, but if they are able to secure one-quarter of the contracts they have made bids for, their force will have to be doubled in order to finish the work in a year's time. Such testimony is not confined to any one firm, but every constructor of any reputation reports the same condition of affairs. And some of them are now at work on contracts which date back two years. Most of this work is the wiring of new houses and business buildings, but the nearing completion of the Edison central station has caused great activity among constructors who make a specialty of private house wiring. Isolated plant work is also very active. All the companies are doing considerable work fitting up mills, factories, work-shops and large office buildings with plants ranging from 10 lamps up to 1,500. The new Girard Insurance building at Broad and Chestnut streets, was lately wired for 1,500 lamps and two 600 light United States machines will soon be placed in the cellar. Motor work is claiming more and more attention every day. Every use to which a motor can be put from operating fans with ⅛ h. p. to running 30 h. p. printing presses, is being brought into active play, and numerous contracts are being made daily for these compact, noiseless transmitters of electrical power. As a whole, trade is in an excellent condition, and as people are becoming more acquainted with the various uses to which the current can be put, the volume of business is considerably increasing.

E. F. C.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
11 Lakeside Building, Chicago, APRIL 6, 1889.

Mr. J. Bridger, the foreign buyer for Shay, Stephens & Co., is visiting Chicago in the interest of that firm.

The Bryan Electric Company, of Bryan, O., has recently been incorporated with a capital stock of $30,000.

"The New York Store," of Chicago, has installed a 16-arc light plant, furnished by the Van Depoele Electric Manufacturing Company.

West Virginia.—An electric street railway is very seriously talked of in West Virginia, from Bridgeport to the Wheeling Creek coal mines.

A Lighting Plant in Portage, Mich.—Portage is to have an incandescent light plant, and one is to be established in Rensselaer, Ind.

The California State Board of Horticulture are about to put electric lights into the building where they hold their sessions at National City.

The Bessemer, Ala., Electric Light Company have started their new plant, consisting of 60 arc and 500 incandescent lights, of the Van Depoele system.

The Elgin, Ill., Edison Light Company have purchased a 40-light Van Depoele arc light plant, to be run in connection with their incandescent plant.

Titusville, Pa., has contracted for a 60-arc light plant for lighting the city. The plant, which is of the Van Depoele system, will be in operation in thirty days.

The Van Depoele Electric Manufacturing Company, of Chicago, are shipping a new 40-light dynamo (arc) to the city of Elgin, Ill., an increase to their city lighting plant.

Birmingham, Ala.—The Merchants' Electric Light and Power Company, of Birmingham, Ala., has ordered two new 150 h. p. engines for its new power station, and two 135 h. p. boilers.

An Electric Light and Gas Consolidation.—The Fargo, Dak., Brush and Incandescent Electric Light Company and the gas company of that city have consolidated with a capital stock of $250,000.

Increase of the Omaha Electric Railway.—During the past week the contract with the Omaha & Council Bluffs Railway and Bridge Company has been amended so that they will now operate 28 cars instead of 24, as formerly.

Western Union Property Taxed.—The Board of Assessors in Detroit have, for the first time in the history of that city, taxed all the property of the Western Union Telegraph Company of that city, as well as that of the United Lines.

Electric Lights for Keokuk.—The water power of the Hubinger artesian wells at Keokuk, Ia., which is to drive the machinery of the incandescent light plant of that city, has been tested. Next week the city will be lighted.

The Omaha Motor Railway, of Omaha, Neb., is a new corporation operating 26 cars with the Thomson-Houston system over 7½ miles of road. The Metropolitan Street Railway, of Kansas City, has ordered three cars of the same description.

The Climax Manufacturing Company, of Corry, Pa., has bought from the Van Depoele people two 300-light incandescent dynamos and one 50-light incandescent dynamo. This plant is to be installed in the Lakeside Hotel at Chautauqua Lake, N. Y.

Pasadena, Cal.—Work on the new electric light plant is now fully under way at Pasadena, Cal., and will soon be completed. One of the first large deals of the new Loan and Trust Company was to loan $60,000, at six per cent., to the Electric Light Company.

Work in the Southwest.—The Electrical Construction Company, of St. Louis, have just finished the wiring of a new opera-house at Decatur, Ill., for 400 lights. They are also installing a central station plant of the Thomson-Houston system at Findlay, Ohio.

The Hill Clutch Works have sold a complete set of gears, pulleys and shafting to the Brush Electric Company, of Buffalo. The contract amounted to $7,000. They have also closed a contract with Swift & Co. at the Stock Yards for the shafting for an isolated plant.

Denver, Col.—It has definitely been decided to build a new electric motor line in Denver, Col. About $36,000 of the necessary $40,000 has been subscribed, and the work of construction is to be immediately begun. It is more than probable that the Sprague motor will be used.

Colorado Springs, Colo.—The station of the El Paso Electric Light Company was destroyed by fire on March 21, and the machinery was badly injured. No cause for the fire is known. A new and improved plant will be put in at once. The company resumed its business promptly.

A Mandamus Writ for Detroit Companies.—An application has been filed for a mandamus writ compelling the Brush Electric Light Company and the Thomson-Houston Electric Light Company, of Detroit, to put their wires underground according to the order of the City Council.

The Midland Electric Company.—At a recent meeting of the Midland Electric Company, of Omaha, Neb., the following officers were elected: L. M. Rheem, president; Flemon Drake, vice-president; L. H. Korty, treasurer and secretary; A. F. Blundell, general manager, and H. A. Kinney, superintendent and electrician.

Southern California.—To bring the large fruit growers of Southern California into direct communication with the dealers in National City, a telephone line is being constructed. The Coast Motor Railroad of San Diego, Cal., has been granted a franchise an

charter provided the whole system is in running order inside of 18 months.

Light for St. Joseph, Mo.—The fight for the contract to light the city of St. Joseph is over. After considerable agitation, the committee decided to award the contract to the Excelsior Electric Company. By the terms, 200 arc lights are called for. Of this number, 40 will be on ten towers, and the remaining 160 will be on mast-arms at the street intersections.

More Electric Litigation.—The Fostoria, O., Electric Light Company is plaintiff in a damages suit for $10,000 against the Northwestern Ohio Natural Gas Company. It seems that the plant of the plaintiff was operated by the defendant. The claim is that the explosion which occurred recently injured the plant of the plaintiff for the amount mentioned above.

A Plant for Dakota.—There has been closed a contract this week for an alternating system incandescent plant of 600 lights to go to Madison, Dak. The Thomson-Houston people furnished this, and they have sold a 50-light arc dynamo to go to the El Paso Electric Light Company in Colorado. The Kansas City Cable Railway has contracted for a 30-light arc dynamo of the same pattern.

A Surfeit of Light.—It would seem as if the town of Griffin Ga., was to have a surfeit of light. The Brush Electric Light Company have taken the contract to light the city on trial. The Thomson-Houston people do not wish to be outdone, so they have secured the privilege of putting in their plant, also on trial. Thus the town will be lighted by two first-class systems without the outlay of a dollar.

Mr. George Cutter, the electrical engineer, of Chicago, who for a long time has been associated with the Thomson-Houston people at Chicago, has severed his connection with them, and is to start in business for himself. He intends to handle electrical specialties, and to represent, in the West, several valuable inventions. Mr. Cutter is well known by all the electricians in the vicinity, and there are none who will not wish him the best of success. For the present he will be located at 43 Lakeside building.

Proposed Electric Railway for Indianapolis.—Starting from a petition circulated by certain taxpayers of one of the large streets of Indianapolis, quite an agitation has been aroused. It seems that the mules drawing the cars are offensive to many of these parties and they have requested the company to substitute electric motor cars. The company are perfectly willing to do this provided that the city grant them a franchise to supply all the street cars in the city with the same agent of locomotion. The question has not been, as yet, decided.

The Chicago Electric Club.—At a meeting of the Chicago Electric Club, held at their rooms last Monday, it was voted that their present quarters were too small and that a change be made as soon as possible. A committee, consisting of Messrs. Terry, Barton, Zimmerman, Kreidler and Kempt, were instructed to look for new quarters and to report at a special meeting to be held Friday night. The club is to have its annual entertainment April 18. This will consist of a dinner, followed by theatricals and music. The entertainment will be strictly by amateurs, mostly the club's members.

An Enlarged Factory.—The Gilliland Electric Company, of Adrian, Mich., have broken ground for the enlargement of their factory. The building to be added is to be of brick, and will be 128 feet long by 46 feet wide. This building will be used exclusively as a wood-working department. It will stand directly in the rear of the boiler and engine room. The frame building that has formerly stood at this point is to be moved and used as a japanning room. The new part is to be one story high and will have a seven foot basement for the lines of shafting and the running gear of the machines. The boiler room is to be remodeled and a larger engine is to be installed. Captain Sydney N. Johnson, of Indianapolis, has been appointed assistant superintendent of the works, and the additions are going up under his supervision. W. A. N.

KANSAS CITY, Mo., March 28, 1889.

Baxter Springs, Kan.—The 500-light Thomson-Houston alternating plant at Baxter Springs will be put in operation this week.

The Gill-Alexander Manufacturing Company, recently organized here with $300,000 capital is for the purpose of introducing a combination-lock for telegraph circuits. All ordinary combinations of dots and dashes pass through the lock without producing any action, but when a certain combination is made a local circuit is closed and then any necessary work may be done. The lock may be set for any combination of dots and dashes, and the length of the combination is also immaterial.

Executions by Electricity.—The House Committee on Criminal Jurisprudence of the Missouri Legislature have reported unfavorably on a bill to execute criminals by electricity. This action was the result of the New York experience, the committee thinking that the experiments made there, in the direction of perfecting a plan for carrying out the provisions of the new statute, have been so unsatisfactory as to render it doubtful whether electricity can be made available for the purpose prescribed.

The Telephone Company have had thirteen legislative bills to interest them. Superintendent Smith's time is now fully occupied in attending to the education of legislators. The rate bill is the only one which has made sufficient progress to create much enthusiasm on either side, and both the bill and the fight which preceded it originated in St. Louis. It reduces the monthly rental to $4 and the toll charges to 15 cents for each five minutes or fraction thereof. President Mulvane emphatically says that he will not attempt to do any work at all at these figures, and that the Telephone Company will retire from the field entirely. He states that a very large amount will be required to be expended on the Kansas City plant during the present year; that it is, in fact, almost worn out, and that, if the company is to quit business, there could not be a better time than the present.

APRIL 4, 1889.

The Armourdale Road.—Three car loads of material for the Armourdale electric railway (Thomson-Houston system) have arrived, and the work of construction will be commenced at once. The road is about one and three-quarter miles long, and is now operated by animals. It is expected to have it in operation by electricity on July 1. There will be five cars running singly. The Vine street motor railway, now operated by Baldwin motors, will be put in operation at about the same time. It will be operated by the same system, and will use trains of two cars each. The road is one and three-quarter miles long.

The New Edison Station.—The time set for opening the new station of the Kansas City Electric Light Company was April 1. The capacity will be 6,000 incandescent lights and the company also expect to do a considerable business in the distribution of power. Hitherto the company have used high tension currents for power purposes, and have not made any great effort to secure such business, but when the new installation is completed power will be furnished by low tension currents, and it is expected that the small steam engine will be a thing of the past in Kansas City. At present about ten per cent. of the current is used in motors.

The Dempsey Low Rate Telephone Bill passed the lower house of the Missouri Legislature last week. It provides that the monthly rental of all telephones inside the limits of cities containing 100,000 inhabitants or over shall not exceed $4. The bill was passed by a vote of 73 to 37. As it required 71 votes to pass it, it may be said that the bill passed by a majority of two.

The fight originated in St. Louis and not in Kansas City, and Mr. Dempsey, who introduced the bill, is a St. Louis man; but considerable interest was taken by Kansas City people, and an anti-telephone league was formed here. The bill now goes to the Senate, and if passed there and signed by the governor, will take effect 90 days after the legislature adjourns.

President Mulvane states that he will retire from business if the law is passed, and permit the Kansas City people to do their talking without any of his assistance. It is difficult, however, to make the public believe that they will be without telephones. Few people understand the complete victory which the Bell patents have obtained, and fall into the error of thinking that some other company will be anxious to supplant the old one. C. W. H.

SAULT STE. MARIE, Ont., April 2, 1889.

Electric Light for the "Soo."—The Ontario and Sault Ste. Marie Water, Light and Power Company made a contract to light "The Sault" with sixteen arc lights, but their attention being called to incandescent lighting, after making numerous inquiries, they decided the town was making a mistake in not adopting the incandescent system, and they then asked the Council to reconsider the thing. The result was that a delegation was appointed to visit Chicago, St. Louis and Detroit to examine the different systems in use. The unanimous adoption of the Heisler incandescent system followed after a thorough examination. The town now has 100 incandescent street lights in place of 16 arc at about the same cost, all the streets being lighted in place of only a few had the arc system been chosen. Nearly every store in town is using the light, and every one speaks in the highest terms of it. The company are using two 250-light dynamos and find they run beautifully, there not having been a hitch since they started. Any person laboring under "the delusion" that incandescent lighting is not adapted to street lighting, ought to take a trip up the St. Mary's River and see the rival Saults on either side—the American on one side, lighted by the arc system, the Canadian on the other, by the incandescent. The difference is so great he must at once and forever be convinced that the incandescent is unsurpassed for street lighting; the appearance of the Canadian Sault being brilliant in the extreme, so much so that its rivals across the river say we are ahead in that if in nothing else.

SOUTHERN NOTES.

DALLAS, Texas., March 28, 1889.

Mr. H. R. Lowry, of the Edison Company, has returned to Dallas, after erecting several isolated plants for his company at Austin and Laredo.

Mr. Jno. Adamson, State representative of the Thomson-Houston Company, paid Dallas a flying visit a few days since in the interest of his company.

Mr. F. M. Henshaw, the well-known manager of the Erie Telephone and Telegraph Company, is confined to his residence with a severe illness. At last accounts there was no improvement noticeable.

Mr. G. E. Harris, formerly of the Queen City Electric Light Company of this city, has gone to Houston, Tex., to take charge of the installation of the plant being erected by the Ft. Wayne Jenney Company.

Mr. Owen J. Cooke, the genial president and manager of the Queen City Electric Company, has gone to St. Louis, Fort Wayne and other points in the interest of his company. Mr. Cooke is untiring in his efforts to keep up the success of the plant, and will use his best efforts to have the new machinery and apparatus shipped at once, which is very much needed, from the fact that the plant is loaded to its full capacity, with a large number of orders for lights on file.

The Dallas Electrical Society met again last evening, and had the pleasure of listening to an admirably written paper from Mr. H. M. Sutton on "Principles of Dynamo Electric Machinery." Mr. Sutton illustrated his paper by means of the black board, which made it exceedingly interesting. Mr. R. K. Saunders and Professor McCormick gave "The Gravity Battery, its construction and chemical action," an interesting subject at any time, which was ably shown by the gentlemen mentioned. Mr. C. O. Harris also read a paper entitled "Need of a Better Understanding with the Fire Underwriters." Mr. Harris read a number of extracts from the constitution and plan of licensing of the New England Electric Exchange, and, as a result of the papers, resolutions were adopted to be transmitted to the State Board of Fire Underwriters asking them to take steps towards the formation of new rules on the subject. There is an urgent demand for new rules governing the installation and maintenance of electric lighting and power apparatus in this State, and as the Society is the only one of its kind in the State they propose to use their best efforts to have the matter adjusted. Mr. Walter A. Crowdus, the well-known electrician and manager of the Electric Fare Box Company, of Nashville, Tenn., was unanimously elected a member of the society.

ST. AUGUSTINE, Fla., March 23, 1889.

Electrical Features of the Ponce de Leon.—One of the largest isolated electric light plants in the world is that in the magnificent Hotel Ponce de Leon, at St. Augustine, Fla. The hotel itself is worth traveling a long distance to see. In fact, it is undoubtedly the handsomest, most complete and most perfect inn on either continent. No expense seems to have been spared in any direction, and everything about the house is of the richest and most generous description. No one who has not actually visited the place can form any adequate idea of the Ponce de Leon, either from photographic or pen pictures. The house is splendidly lighted, there being electric lights, and plenty of them, in each of the more than 400 or 500 rooms. All told, there are close upon 4,500 Edison incandescent lights in the building (including those in the Alcazar, another hotel under the same management). To supply these there are five 320-ampère (640 light) Edison dynamos, though one would think this was running the dynamos up to their full capacity, to say the least. The engines are of the Armington & Sims make. There are four of these well-known engines, three of 60 h. p. each and one of 25 h. p. The boilers are the Babcock & Wilcox, of which there are four of 104 h. p. each, furnishing steam for the pumps, elevators, etc., in addition to what is used in connection with the electric lights. A large Berryman feed-water heater is pointed out with pride to those favored with a view of the plant, and they are told that it gives excellent satisfaction and is wonderfully economical in its operation.

Mr. John Shaw, Jr., is chief engineer of the Ponce, and has general charge of all the steam and electrical appliances.

Mr. John S. Bull is the electrician, and has the dynamos, etc., under his immediate care. Mr. Bull's name accurately suggests his nationality. If it did not, one would only need to converse with him a moment to be aware that he was "English, quite English, you know."

Three Sprague motors are kept running. Two of them, of 2 h. p. each, furnish power for blowers in the Russian bath in the Casino (also under the same management), while the other is used for running a ventilating fan in the dynamo room.

The Ponce de Leon has, of course, all the latest improvements in the way of electric bells, annunciators, etc. One annunciator has no fewer than 480 drops. All this work, which is very creditable, was done by the Western Electric Company. There is a handsome clock, manufactured by the Cleveland Electric Manufacturing Company, and several self-winding clocks, manufactured by the American Manufacturing and Supply Company of New York which are said to give excellent satisfaction.

Altogether the electrical features of the Ponce are in keeping with the rest of the work about the house, and this is saying considerable. W. J. J.

THE TELEGRAPH.

Police Telegraphs.—Dr. F. B. Herzog, of the Telesome Company, has notified the New York Police Commissioners that he will remove his wire from all the police buildings, and asked for transcripts from the records of all transactions between him and the Police Department. The communication was ordered on file.

Western Union in Pennsylvania.—In the action against it by the State, to compel forfeiture of its charter for alleged consolidation, the Western Union Company now denies that it or the Baltimore & Ohio is subject to the State laws, etc. It also denies consolidation, and that the Baltimore & Ohio was a competing line.

THE TELEPHONE.

Delaware.—A bill has been introduced in the Delaware Legislature to tax telephone companies.

Regulating Rates.—The bills to cut down rates have failed in the Arkansas and New York legislatures.

California.—The Bell Telephone people recently discovered a number of infringing instruments at Oroville, and confiscated them all.

Bell Telephone Capital.—Another hearing before the Massachusetts Legislature on the question of increasing the American Bell capital stock will be held on April 11.

Virginia.—The Parker Telephone Company has been formed, with a capital stock of $10,000, to build a telephone line from Accomac to Onancock by B. T. Parker and others.

The North Carolina Phonograph Company has been formed at Morganton, N. C., by J. L. Martin, E. B. Claywell and others, with a capital stock of $100,000.

Arkansas.—The Highland Improvement Company, of Helena, are negotiating with the Erie Telephone Company for lines to Memphis, etc.

Maryland.—The American Telephone and Telegraph Company of Maryland has been incorporated by E. J. Hall, Jr., and others, with a capital stock of $15,000 to build and operate telephone and telegraph lines in Maryland.

THE ELECTRIC LIGHT.

Cordele, Ga., is to have an electric light plant.

Anderson, S. C. will probably have an electric light plant.

Bristol, Pa.—The Pennsylvania Railroad Depot is to be lit by electricity.

Anniston, Ala., has contracted for 18 Thomson-Houston arcs of 1,200 c. p.

Albina, Ore., will issue bonds for $15,000 to be put into an electric light plant.

Salem, Va.—Dr. W. T. Younger is Mayor of Salem, which will probably put in a plant.

Selma, Ala.—An electric light company has been formed to put in a Westinghouse plant.

Portsmouth, Va.—An electric light plant is to be put in at the Navy Yard at Portsmouth.

Astoria, Ore.—A Thomson-Houston plant of 100 arcs and 2,000 incandescents is being put in.

Farmersville, La.—Mr. W. P. Chandler will negotiate with manufacturers as to plants for small towns.

Menominee, Mich.—A Brush incandescent electric light plant has just been sold for use in Menominee, Mich.

Point Pleasant, W. Va.—The Point Pleasant Electric Light and Power Company have contracted to light the town.

Macon, Ga.—The Macon Gas Light and Power Company have put in a 600-light Thomson-Houston alternating machine.

Decatur, Ala.—The Decatur Light and Power Company contemplate adding an electric light plant to their gas works.

Marysville, Kan.—Mr. C. H. Parrish, of Bigelow, Kan., has bought an interest in the Marysville Electric Light Company.

Grass Valley, Cal.—The Grass Valley Gas Light Company will probably establish an electric light plant at Nevada City.

Danville, Ky.—The Commercial Club's committee on public improvements is considering the desirability of electric lights.

Hickory, N. C.—The Hickory Electric Company, Limited, is now running 20 arcs and 225 incandescents of the Brush system.

California.—The Legislature has appropriated $112,500 for an electric light and water power plant at the Folsom Penitentiary.

Searcy, Ark.—The Searcy Electric Light Company will not put in its plant until next fall. Mr. M. G. Pettey is the president.

Oil City, Pa.—Mayor J. H. Payne and other city officials have been inspecting the electric lighting at Pittsburgh. They want a plant.

Kingston, N. Y.—The Mayor says that the city should have 300 arc lights of 2,000 c. p., and should own and operate its own plant.

Newton, S. C.—Mr. L. L. Witherspoon, Mayor of Newton, wants some information as to cost of a plant. It is proposed to issue $10,000 in bonds.

Hackensack, N. J.—The contract for street lighting has been awarded to the Edison Company at $3,000 a year. Lamps of 30 c. p. will be used.

Saginaw, Mich.—The Saginaw Electric Light and Power Company has bought out the Fort Wayne Jenney plant, and ordered a new plant of 800 Slattery incandescents. The presi e t

is A. McIntyre; secretary and treasurer, R. Khuen; superintendent, J. Herman.

Warren, R. I.—Messrs. W. A. Stedman and S. G. Stiness have bought out the Warren Gas Company, and are to supply both gas and electricity.

Union, N. J., has been offered electric lights at $95 each per annum by Mr. J. C. Mowry, who also offers one free light with every ten taken.

Union Stock Yards, Chicago.—A No. 7 Brush arc dynamo, with complement of lamps, has recently been furnished to the Union Stock Yards, of Chicago.

The National Electric Light Association will hold its Niagara Falls meeting on Aug. 6, 7 and 8, and the Edison convention will be held there on Aug. 13.

Livingston, Mont.—The Livingston Electric Light Company has been formed by L. Orschel, G. S. Chambers, T. A. Krieger and others with a capital stock of $25,000.

South America.—The Brush Electric Company, of Cleveland, O., have lately received a cablegram ordering two No. 7 arc dynamos, dials, etc, to be shipped to South America.

Woonsocket, R. I.—The Woonsocket Electric Machine and Power Company has increased its capital stock to $200,000. It will put in the Thomson-Houston alternating system.

Oakland, Cal.—The new station of the Oakland Gas Light and Heat Company will include a steam plant of 1,000 h. p., 800 Thomson-Houston arcs and 2,000 Westinghouse incandescents.

The National Electric Light Association, Mr. A. V. Garratt, secretary and treasurer, has removed its headquarters to Room 512, Metropolitan Telephone Building, 18 Cortlandt street.

Marietta, Ga.—The officers of the Marietta Electric Light Company, which is putting in a Thomson-Houston plant, are T. W. Glover, president; B. R. Legg, secretary, and A. M. Dobbs, treasurer.

The Jackson, Miss., Gas Light Company has a ten year contract with the city for lighting its streets by electricity, and has installed a 70 arc light plant of the Indianapolis Jenney system.

Town Talk, Cal.—It is proposed to put in an electric light plant at Town Talk, Nevada County, Cal., which shall also furnish lights for Grass Valley and illuminate the highway between the two places.

Harrodsburg, Ky.—The Harrodsburg Electric Light and Power Company has been formed with a capital stock of $25,000, by G. Bohon, R. C. Nuckols, L. D. Cardwell, and others. It will put in a plant immediately.

San Jose, Cal.—The San Jose Brush Company will increase its capital stock and enlarge its plant, to do an incandescent business. The president is A. Riehl, treasurer T. Rea, secretary and superintendent W. W. Gillespie.

Savannah, Ga.—The Brush offices in Savannah have been destroyed by fire. They were situated in the Y. M. C. A. building, which succumbed with others to a vast conflagration started by a man lighting gas in a store.

Madison, Dak.—The officers of the Madison Electric Light Company, recently formed, with a capital stock of $25,000, are: President, W. H. Jones; secretary and treasurer, G. D. Winter; superintendent, Stanley A. Jones.

Sandusky, O.—An electric light and power company has been formed at Sandusky, Ohio, with the following officers: President, M. H. Brinkerhoff; Vice-President, Dr. R. N. McCannell; Secretary, W. Clark; Treasurer, Charles F. Plumb.

Fernandina, Fla.—The Fernandina Light and Power Company has now formally incorporated, with a capital stock of $20,000. Among the incorporators are F. W. Hoyt, W. O. Jeffreys, J. H. Prescott, W. B. C. Duryee and G. A. Latham.

Springfield, Ill.—The Springfield Electric Light and Power Company has been incorporated recently by A. L. Ide, G. N. Black and S. D. Scholes, with a capital stock of $100,000. It will not only furnish current and light, but manufacture electric machinery.

Denver, Col.—Electric lighting seems to be growing in favor in Denver, as one of the local companies there not long since placed an order for two Brush arc dynamos, each having a capacity of 65 lights of 2,000 c. p.

Rome, Ga.—The Rome Gas Light Company has contracted to light the city with 17 arc lights, 20 incandescents of 65 c. p. and 17 of 32 c. p. The company has contracted with the Thomson-Houston Company for all the necessary apparatus. Mr. G. G. Childs is secretary of the company.

Benton Harbor, Mich.—The Benton Harbor & St. Joseph Electric Light Company was organized in February, and both towns have now passed franchises for it. The offices will be in St. Joseph and the power house in Benton Harbor. Mr. W. W. Bean is the president and treasurer.

Kansas City, Mo.—The fine new Edison station of Mr. E. R. Weeks at Kansas City, has gone into operation with an initial load of 4,000 lights and a capacity of 8,000. The ultimate capacity of the station is 30,000 lights, and it looks as though the limit will be reached in but a year or two.

Whatcom, Wash. Ter.—The Fairhaven Land Company controls a fine water-power and is now lighting its mill with electricity. The city of Whatcom has granted it the privilege of erecting poles and stringing wires through the street. It will at once proceed to enlarge its plant and erect poles and wires.

Sing Sing, N. Y.—There is a dispute between the Sing Sing Gas Manufacturing Company and the local Electric Light Company as to the lighting of the streets. An injunction has been obtained by the electric light company preventing President Many, of the Board of Trustees, from making a contract with the gas company.

Jamestown, N. Y.—A special dispatch from Jamestown, April 4, says: "To-night the Opera House was crowded at a citizens' meeting, and after an exciting discussion the Common Council was by vote requested to close a contract with the Jamestown Electric Light Company for an unspecified number of street arc lamps, at $6 per lamp per month. Mayor Price is now in Albany to get a bill enacted enabling the city to issue bonds for a municipal plant."

Waterhouse Arc Lighting Installations as follows are reported by the Westinghouse Electric Company; Central stations: South Omaha, Neb., Electric Light, Heat and Power Company, increase of 35 lights (35 previously installed); Berlin Falls, N. H., Forest Fibre Company, 35 light; Bookings, Dakota, Electric Light Company, 20 lights. Isolated plants: Philadelphia, Pa., Pennsylvania Railroad Company, 70 lights; Cincinnati, Ohio, Weir Frog Company, 35 lights.

An Electric Light Challenge.—We have received from Mr. Harold P. Brown a copy of a challenge which he states he has forwarded to Mr. Geo. Westinghouse, Jr., for a competitive test of Westinghouse alternating apparatus with continuous current apparatus of the Mather, Schuyler, Jenney, or Thomson-Houston system. The test is to be made by the Electrical Testing Bureau of Johns Hopkins University. The loser is to pay all expenses and buy the successful apparatus for presentation to the University. Mr. Brown intimates at the end of his challenge that if it is not accepted he will feel himself at liberty to carry out some such test on his own initiative.

El Dorado, Kan.—The plant of the Consolidated Light Company represents a capital of over $60,000, and includes both gas and electricity. The company are running 20 Thomson-Houston arcs for the city, and supply a number of lights to the stores, etc. They have an engine of 65 h. p., and 10 miles of circuits. Mr. W. J. Robbins is the manager of the company, and Mr. F. A. Brooks the electrician.

Brooklyn, N. Y.—Mayor Chapin recommends that the question of additional electric lights be submitted to the City Works Commissioner. He quoted figures to prove that the city was not being overcharged. He showed that the cost of street lighting in 1870, when the population was 396,000, was $450,000; in 1875, population 484,000, $575,000; in 1880, population 566,000, $326,200, and last year, with a population of about 800,000, $480,000. The same appropriation has been made for the present year, and the Mayor thinks an unexpended balance will remain.

A Million-Dollar Mortgage.—A document was filed in the Register's office last week by which the Manhattan Electric Light Company, Limited, of New York City, mortgaged all its franchises and property to the Holland Trust Company, as trustees, as security for the payment of first mortgage bonds aggregating $1,000,000. The object of issuing the bonds is to secure money to purchase apparatus and improvements. The bonds are for $1,000 each, and are payable in thirty years at 5 per cent. interest. Abraham Herrman is the president of the company, and Lazarus Levy is the secretary.

APPLICATIONS OF POWER.

Newton, Mass., is to have a Thomson-Houston electric road, overhead system.

Seattle, Wash. Ter.—The Seattle Electric Railway and Power Company is extending its line.

Denver, Col.—The Denver Tramway Company will build an electric road about a mile long.

Grand Rapids, Mich.—The Grand Rapids Street Railway Company is adopting electric motors.

Buffalo, N. Y.—The East Side Street Railway Company is to operate by electricity using overhead wires.

Lake, Ill.—The Lake, Hyde Park & Calumet Street Railway Company has asked for an electric franchise.

Nashville, Tenn.—The Main Street and Lischey Avenue Company are now preparing for electric motive power.

British Columbia.—The National Electric Tramway and Lighting Company, of Victoria, has been incorporated.

Sioux City, Ia.—The street railway company, of which Mr. Peavey is president, has been given permission to operate by electricity.

Salt Lake City.—The Sprague Company have closed a contract for an electric road in Salt Lake City, 7 miles long, starting with 10 cars.

Orangeburg, S. C.—A local company has been formed to build a street railway. It has a capital stock of $25,000, and electricity may be adopted.

Red Bank, N. J.—W. T. Corlies, of Red Bank, and C. H. White, of New York, propose to build an electric road from Red Bank to Seabright.

Houston, Tex.—The Houston Street Railroad is to adopt electricity as a motive power. A controlling interest has been bought by Chicago capitalists.

Raleigh, N. C.—Mr. E. R. Stamps, of the Raleigh Street Railway Company, will probably adopt electric motors, having the matter now under consideration.

Southington, Conn.—The Southington & Plantsville Electric Tramway Company's road has gone into operation. It is one mile long, and is now running two cars.

The Boston Electric Elevated Railroad Company, which proposes to use the Riley system, is still before the Massachusetts Legislature asking for incorporation. Several hearings have been had on the subject.

Portsmouth, N. H.—The directors of the new street railroad have decided to run cars by electricity, providing the city will grant the permission. The contracts call for the completion of the road, with everything in running order, June 15.

The Betts Motor.—Mr. I. F. Betts, of Wilmington, Del., is in the market with a neat little motor ranging from 3 to 10 h. p. for various uses. The motor has been used at Wilmington and the testimonials show it to have given a good deal of satisfaction.

Truckee, Cal.—The *Truckee Republican* states that 18,000 acres of land have been bonded along the Truckee River for the purpose of erecting an electrical plant near Bronco, between 17 and 18 miles distant from the Comstock. Power is to be transmitted to the Comstock to operate the mills there.

Boston, Mass.—In a recent letter to the Thomson-Houston Electric Company, Mr. H. M. Whitney gives details of the road in Cambridge, operated on the Thomson-Houston system, and says: "My own confidence in the electric system for street transportation has been strengthened and confirmed by the success of the work in Cambridge."

North Attleboro, Mass.—An electric street railway to connect Wrentham, Plainville, North Attleboro and Attleboro appears to be a certainty. A proposition for its construction has been received from W. A. Boland, of Boston, representing a syndicate. The proposition was accepted. It is stated that work will commence at once, and cars will run by June.

Dallas, Tex.—Mr. R. A. Ferris, vice-president and general manager of the Dallas Consolidated Street Railway Company writes us as follows: "Our company has taken no action towards changing to an electric plant. In case we procure additional franchises on unoccupied streets, and extend our plant, we thought of the use of other motors than mules. But it may be some time before we can take the matter up."

Port Chester, N. Y.—The Port Chester, White Plains & Tarrytown Electric Railway Company has submitted its plans and specifications showing where it is intended to run the tracks, turnouts, etc., through the village of White Plains, to the Board of Trustees of that village. There being no objection to the plans, they were received and filed. The Company is pushing the work forward with all possible haste, all obstacles being overcome.

Topeka, Kan., is proud of having the "largest electric railway system in the world." It is just completed. It is of the Thomson-Houston system. The plant is owned by the Rapid Transit Railway Company, of Topeka, and has been built at a cost of $600,000. There are 16½ miles of track, and the overhead wire is used. The company will operate 43 cars at a maximum speed of eight miles an hour, the legal limit. The station plant includes nine generators driven by two engines of 1,200 h. p. The cars and station are lit by electricity.

Lawrence, Mass.—There is a project on foot among the prominent business men of Haverhill to utilize the water power at Mitchell's Falls, by establishing a generating plant on the bank of the Merrimac River, and transmitting the power to Haverhill, which is about three miles distant, to be used there in supplying motive power for the numerous shoe shops throughout the city. Several competent engineers have looked the situation over, and consider the plan a feasible one, and as the parties interested seem inclined to push the matter it is quite probable that before another year Haverhill will be turning out shoes made by power derived from the alternating current.

PERSONALS.

Mr. Edward Blake, of Boston, is giving a course of lecture at the Massachusetts Institute of Technology. The subject treated upon is "The Theory and Practice in the Construction and Application of Electric Motors."

Mr. Leo Daft.—The Plainfield, N. J., *Daily Press* republishes our recent portrait of Mr. Daft, and says he is the man to whom that "community is impatiently and expectantly looking for the street railway that they long for."

Mr. Alexander Kempt, the Chicago representative of the Brush Electric Company, closed the month of March by sending to the home office at Cleveland an order for a 65-light Brush dynamo, with full complement of lamps, dial, etc.

Mr. W. H. Fleming, the electrical engineer, recently with the Sawyer-Man Company, has gone to Havana, Cuba, in the interest of the Spanish-American Electric Light Company, to supervise the finishing work on the 10,000 light Westinghouse plant now being put in there.

President T. Wood, of the Ohio Gas Light Association, at the recent Mansfield, O., meeting, said: "Incandescent electric lighting is making rapid progress among us, and we must face the music and be equal to the emergency. Shall we fight it, ridicule it or capture it?"

Mr. W. J. Syms.—The death is announced of Mr. W. J. Syms, a leading gunmaker of this city, who at one time was president of the Franklin Telegraph Company and vice-president of the Atlantic and Pacific Telegraph Company, until they were absorbed in the Western Union.

Mr. R. T. McDonald, general manager of the Fort Wayne Jenney Electric Light Company, was the victim of a somewhat serious accident recently. While superintending some work at the new factory, he was struck on the head by a falling brick. He was stunned and is now confined to his home.

Mr. John E. Hudson, vice-president and general manager of the American Bell Telephone Company, has now been elected to the presidency of that corporation. This change of title is a deserved recognition of the careful and conscientious service given during past years, and will tend in every way to advance the best interests of the company.

Mr. J. Willis, manager of the Nashville Light and Power Company, has resigned his position to take charge of the electric railway now being constructed by the Thomson-Houston Company for the McGavock & Mt. Vernon Railroad Company of that city. He reports that work is being actively pushed on the plant, which will include two 100 h. p. Phœnix engines.

Mr. W. Stanley Currie.—An international wedding will take place at Easter, that of Miss Anita Renedle, of West Fifty-first street, to W. Stanley Currie, of London. Mr. Currie is a prominent Cambridge man and an expert electrician. He is a son of the late Lord High Commissioner to Agra and cousin to ex-Chairman Currie, of the Bank of England. Sir Philip Currie, now Permanent Under Secretary, is his second cousin. Mr. Currie has purchased a house at Philadelphia, as he is connected with a large electrical company in this city.—*N. Y. Sun.*

MISCELLANEOUS NOTES.

Wilmington, Del.—The city council wishes to have all wires put under ground by Dec. 1, 1892.

The Union Switch and Signal Company's earnings last year were $678,226 and the expenses $561,481.

The Electric Sugar Refining Company.—In the suit of Mr. J. Moore against the company Judge Beach has issued an injunction restraining the defendant officers and the National City Bank from using moneys claimed, and requiring cause to be shown why a receiver should not be appointed.

The American Medical Association.—This body will hold its annual meeting at Newport, R. I., June 25, 26, 27 and 28. An exhibition will be held in connection with the meeting, to include electrical apparatus. Dr. C. A. Brackett, Newport, R. I., is the chairman of the sub-committee on exhibits and should be addressed on the subject by intending exhibitors.

Boston Electric Club.—The new and cosy rooms of the Boston Electric Club, at 7 Park street, now present a remarkably attractive appearance. A handsome Mason & Hamlin upright piano has been placed in the main parlor, and on the wall directly above the instrument there has been put an electric clock. A notable addition in the card-room is also noticed an elaborate buffet with polished brass trimmings, and having all necessary appurtenances.

BUSINESS NOTICES.

Battery Cut-Out.—Attention is called to a simple device for disconnecting gas lighting batteries if accidentally grounded. It is cheap, sensitive, never needs watching, and has no clockwork to be kept wound. Terms furnished by the Electric Supply Company, No. 3 South Warren street, Syracuse, N. Y.

Patterson, Jordan & Gottfried, 146-150 Centre street, carry a complete stock of brass and iron machine and wood screws, cap and set screws, all kinds of bolts, taps, files, twist drills, brass and rubber tubing, brush copper, rod and sheet copper, brass rod, sheet German silver, sheet brass, machinery, tools, hardware, etc. Electric motor supplies.

The Canton, O., Steam Pump Company have just issued a very neat and pretty catalogue for 1889-90 of their well-known pumps for general purposes, including electric light and power plants. The company will mail it to any address on application, together with a lithographic sheet, which is worked in six colors, and has a beautiful landscape as a centre piece.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS ISSUED APRIL 2, 1889.

400,430. Galvanic Battery; Edward H. Crosby, of Boston, Mass. Application filed Jan. 10, 1889. In an electric battery the combination of a zinc-containing jar, a carbon pencil disposed within said jar and insulated therefrom by hard rubber rings, and a packing disposed around said pencil, consisting of wool waste saturated with a solution of sal ammoniac.

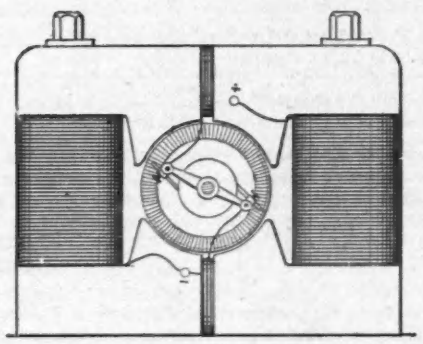
400,463. Lightning Arrester; Myron D. Law, of Philadelphia, Pa. Application filed Oct. 2, 1888. A lightning arrester comprising a solenoid and sliding core, having in its upper end an elongated slot, a fixed conductor or contact-plate, located below the solenoid, a gravity-lever pivoted above the solenoid, and having its upper end in engagement with said core-slot, and at its lower end a companion contact-plate for said fixed plate, and circuit connections. For description see THE ELECTRICAL WORLD, Sept. 29, 1888.

400,464. Lightning-Rod and Coupling; Spencer R. Lawshe, of Chicago, Ill. Application filed Oct. 15, 1888. Consists of a method of fastening the coupling burr to the several sections of the rod.

400,473. Device for Supporting Electric Lamps; Alexander T. Moore, Jr., of New Bedford, Mass., and Horace A. Fitch of Schenectady, New York. Application filed May 18, 1888. The improvement consists in the combination with a cable for suspending an electric lamp of a rotary drum, to which such cable is at one end attached, and around which the cable may be wound, a counter-balance consisting of a spring within the drum, or like device, means comprising dogs for retaining the drum in any position into which it may be adjusted, and metal side pieces, one of which has an opening for a stud on the bracket-arm and the other having a trunnion whereby the two conductors or wires of the cable may be maintained in electrical communication with the main wires of the electric system, notwithstanding the adjustment of the drum into different positions.

400,476. Electric Arc Lamp; Samuel E. Nutting, of Chicago, Ill., Assignor to the Nutting Electric Manufacturing Company, of same place. Application filed Aug. 14, 1888. The feeding mechanism consists of a clock-work controlled by a brake.

400,486. Transf·r System of Electric Distribution; Edwin Wilbur Rice, Jr., of Lynn, Mass. Application filed Oct. 31, 1888. A system of electrical distribution, comprising alternating current mains leading from a point of alternating current supply, one or more converters or transformers of the ordinary description connected to said mains, leading wires or mains connected with the secondaries of said converters and one or more induction transfer-coils connected across said leading wires and having con-



400,680. PREVENTION OF SPARKING IN MOTORS, ETC.

nected with them two or more sub-circuits or distributing wires, each two sub-circuits having a fraction of the transfer-coil included between them.

400,492. Electric Gas-Lighting Device; David Rousseau, of New York, N. Y. Application filed July 6, 1888. The parts are arranged in a novel manner, so as to be concealed beneath an imitation candle or shield.

(1) 400,515. (2) 400,516. Apparatus for Regulating Current or Potential in Secondary of Transformers; Elihu Thomson, of Lynn, Mass. Application filed Jan. 10, 1889. For description see page 218, this issue.

400,520. Arm-Support for Telephones; Clarence R. Tuttle, Chicago, Ill. Application filed Feb. 4, 1889. An arm support for telephones, consisting of a segment portion terminating in an attaching-bar, and a hook at each end of the same for engaging the lid of the jar box.

400,523. Harmonic Telegraphy; François Van Ryssel-berghe, of Brussels, Belgium, Assignor, by direct and mesne assignments, to himself and the Phono-Multiplex Telegraph Company, of Baltimore County, Maryland. Application filed Sept. 8, 1886. In a tone or harmonic telegraph, the combination, with a rotating axis and a number of independent circuit-controlling wheels mounted thereon, normally out of circuit, of a number of brushes making contact with the wheels, a normally open branch circuit for each wheel, and a key for closing each branch. See illustration.

400,525 Electrical Railway Signaling; William H. Waddell, of Lexington, Va. Application filed Aug. 21, 1888. The object of the invention is to provide an improved electrical railway signal whereby, when two railway trains approach within certain distances of each other, one ar more signals will be sounded upon one or both of the trains, thereby notifying the engineers and giving them time in which to stop their trains before a collision occurs.

400,552. Telegraph Wire Carrier; Robert S. Donaldson, of Wilkinsburg, Pa. Application filed Dec. 16, 1887. The invention consists of sheaves or rollers, which, being properly mounted, are temporarily placed upon the arms next to the insulators of a wire that is to be removed. The wire is detached from its insulators and placed between the sheaves which serve as guides, and reduce the friction to such an extent that a very long section of wire may be readily drawn out, and the new section of wire attached to the end of the old at the same time drawn into place.

400,591. Telephone Transmitter; William J. Morton, of New York, N. Y. Application filed Feb. 17, 1888. This invention consists of a telephone containing a fixed electrode having an opening, a movable electrode entering and loosely moving in said opening, an independently-vibrating support carrying said movable electrode, the said electrodes each having a surface disposed substantially in the same plane, and a mass of comminuted conducting material in contact with said surfaces.

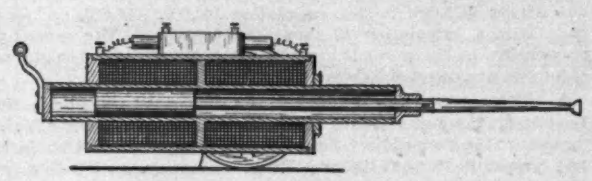
400,600. Insulating Pipe Coupling; Frederick C. Rockwell, of Hartford, Conn. Application filed Jan. 26, 1889. A coupling, consisting of a tubular core of rigid material and an exterior body of insulating material, the ends of the dielectric body being threaded to receive the ends of pipes.

(1) 400,661. (2) 400,662. (3) 400,663. (1) Apparatus for Determining Electric or Magnetic Forces; (2) Art of Determining the Value of Electric, Magnetic, or Electro-Magnetic Forces by Weight; (3) Apparatus for Determining the Value of Electro-Magnetic Forces by Weight. Adolphus Gipperich, of Richmond, Va. Applications filed respectively Jan. 24, Sept. 25 and Oct. 2, 1888. The inventions consist in means for determining magnetic or electric or electro-magnetic forces by weight, and to the mode of and means for neutralizing the effect of such forces or currents upon a body influenced thereby, so as to leave said body free to the influence of like forces from a different source, such as an opposing weight in a pair of scales.

LIBRARY OF THE UNIVERSITY OF CALIFORNIA.

400,669. Safety Device for Electric Circuits; William J. Hammer, of Boston, Mass. Application filed Dec. 9, 1886. The combination, with an electric conductor, of a safety catch normally in the circuit thereof, a substitute safety catch of greater conducting capacity, and means for automatically placing the latter in circuit upon the breaking of the former. See illustration.

400,680. Prevention of Sparking in Electric Motors and Generators; Daniel Higham, of Philadelphia, Pa., Assignor to the Higham Electric Motor Company, of same place. Application filed March 5, 1887. An electric motor or generator having field-magnet coils on its cores and counter distorting coils



400,809. ALTERNATING CURRENT RECIPROCATING ENGINE.

on its pole pieces, so as to maintain the neutral point in a constant position, and thus to avoid sparking.

400,692. Arc Lamps; George M. Lane, of Asbury Park, N. J. Application filed Dec. 26, 1888. The object of the invention is to devise a novel and simple means for regulating the length of the arc, which is effected by having the adjusting-magnet adjustable to and from the pivotal supports of a vibrating frame or lever.

(1) 400,724. (2) 400,725. Trolley for Electric Railways; David Allen Ainslie, of Richmond, Va. Applications filed (1) April 12, 1888; (2) July 27, 1888. (1) A trolley for electric motor cars, comprising the combination of a standard, provided at its tops with a gimbal-ring, a staff mounted on a pivot in said gimbal-ring with its lower end free, so as to have a swinging movement in all directions, and a cylinder on the upper end of the staff. (2) A cylinder with tapered sides and segment grooves or ridges on the sides enables the trolley to readily take or connect with a wire, and especially a wire that may extend in an oblique direction, such as a wire at a switch.

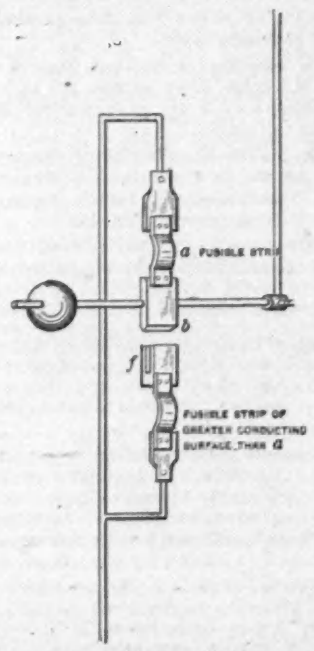
400,726. Method of Regulating Electric Currents; Joseph W. Balet, of New York, N. Y., Assignor of one-half to Robert Dunlap and Luke F. Cozans, of same place. Application filed Jan. 21, 1888. The method of regulating electric currents automatically, which consists in conveying the main currents or a portion of the main current into one or more storage batteries, so as to absorb the surplus energy of the main current when the main current is too strong for the work, and adding the current of as many storage-batteries to the main current as may be necessary to supply the deficiency of electrical energy in the main circuit when the main current is too weak to do the work.

(1) 400,732. (2) 400,733. (1) Electric Switch. (2) Switch for Electric Circuits; Sigmund Bergman, of New York, N. Y., Assignor to Bergman & Co., of New York. The improvement relates more particularly to switches employed in electric lamp circuits, and consists of details of construction.

(1) 400,746. (2) 400,747. Magnetic Separator; Gurdon Conkling, of Glens Falls, N. Y. Application filed July 12, 1888. A conveyor, a series of aprons to operate transversely to the conveyor and at different distances from the same, a magnetized plate secured in proximity to each of the aprons, and suitable driving mechanism for actuating the aprons.

400,750. Alarm System; Charles A. Cox and Joseph F. Cox, of Louisville, Ky. Application filed Nov. 5, 1888. Simple means are provided which can be quickly adjusted to subsequently automatically sound an alarm in one or more rooms, and thereby indicate the arrival of any predetermined period or periods of time.

400,764. Underground Conduit; Patrick R. Greene, of Brooklyn, N. Y., Assignor of two-thirds to Peter Byrne, of Jersey City, N. J., and John Claffy, of Brooklyn, N. Y. Application filed Sept. 15, 1888. A conduit section composed of cement, and having a laterally-arranged well or man-hole



400,669. SAFETY DEVICE FOR ELECTRIC CIRCUITS.

formed integral therewith, to form a T in cross-section, and a series of longitudinal tubular perforations extending from the well the entire length of the section.

400,795. Spark Coil; Francis H. Root, of Chicago, Ill., Assignor to the Root Electric Gas Lighting Company, of Illinois. A core consisting of pliable metal strips laid together flatwise, and a winding which is wound to provide gaps or notches, whereby the core may be readily bent and brought substantially within the radius of a circle.

400,808. Switch Device for Electric Currents; Joseph A. Turner, of St. Louis, Missouri, Assignor to Charles E. Turner, of same place. Application filed March 5, 1888. This is a device to transfer the electric current from one galvanic battery to another, or to a number of batteries in continuous order.

400,809. Alternating Current Electric Reciprocating Engine; Charles J. Van Depoele, of Lynn, Mass. Application filed Sept. 13, 1888. In a system of electro-magnetic reciprocating engines a source of electricity giving defined phases of current in a closed circuit, engines having motor coils placed in said circuit and energized by the said defined currents, and a magnetic pis on or plunger placed under the influence of the said coils. See illustration.

400,830. Electric Car; George Herbert Condict and Victor Angerer, of Philadelphia, Pa., Assignors to the Electric Car Company of America, of same place. Application filed June 20, 1888. The invention comprehends a regulator arranged upon the under part of the car or elsewhere, with connecting mechanism extending to each end or platform of the car, and detachably supported at either end of the car is an operating lever or handle, which when shifted from one end to the other in reversing the travel of the car is automatically connected with the connecting mechanism for operating the regulator.

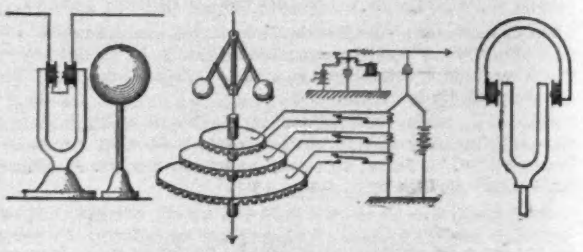
400,838. Dynamo Electric Machine; Justus B. Entz, of New York, N. Y., Assignor to Thomas Alva Edison, of Llewellyn Park, New Jersey. Application filed Jan. 12, 1889. In a dynamo-electric machine or motor an armature carrying independent insulated conductors, and alternate supporting strips to which are attached collecting rings, forming terminals for the said conductors.

(1) 400,842. (2) 400,843. (1) Secondary Battery. (2) Distribution of Electricity by Secondary Batteries; William W. Griscom, of Harvard College, (2) Assignor to the Electro-Dynamic Company, of Philadelphia. (1) Assignor to the Electrical Accumulator Company, of New York. Applications filed (1) Dec. 18, 1888; (2) Jan. 12, 1889. (1) Means for supporting both elements above the bottom of the cell, consisting of fixed points located on opposite sides of both elements between the upper and lower edges. (2) The combination of a primary generator of electricity, charging circuit, a secondary battery, a working circuit containing a series of translating devices, a compensating resistance to be inserted and withdrawn with respect to the working circuit between the battery and translating devices, a switch or circuit changer for inserting and withdrawing said resistance and an electro magnet located in a branch circuit between the dynamo and battery and between the battery and translating devices to control said switch.

400,862. Secondary Generator for the Conversion of Electrical Energy by Induction; William Lowrie and Charles James Hall, of London, County of Middlesex, England. Application filed May 24, 1887. A secondary generator or induction apparatus comprising one or more unit pairs of straight magnetic cores, each core being separately built up of flat thin plates square or rectangular in shape without reentering angles, and having centrally mounted thereon superposed primary and secondary coils, a pair of the said straight cores being subsequently magnetically and mechanically united close to the coils by bending and alternately overlapping the extended ends of the several plates and clamping them together in the form of an elongated link.

400,866. Electric Condenser; William Marshall, of New York, N. Y. Application filed Dec. 30, 1888. For description see THE ELECTRICAL WORLD, Oct. 8, 1887.

400,880. Railway-Signal; Samuel T. Stewart, of Deposit, N. Y. Application filed Jan. 21, 1888. The invention consists in an electrical signalling device for indicating the approach of railway



400,523. HARMONIC TELEGRAPHY.

trains at highway crossings or other places remote from the operating mechanism of the signal-circuit, which is put into action by passing trains.

PATENT ISSUED MARCH 26, 1889.

400,395. Electric Distribution by Storage Batteries; Stanley C. C. Currie, of Philadelphia, Pa., Assignor to the United Electric Improvement Company, of Gloucester, N. J. Application filed May 16, 1888. In a system of electrical distribution, the combination, with a main line conductor an electric generator and an accumulator of a supplementary main conductor, lamp circuits or wires connected to said main conductor, and an electric switch, by means of which the supplementry conductor and the accumulator may be thrown in circuit with the main conductor.

PATENTS EXPIRED APRIL 9, 1889.

125,387. Improvement in Distributing Electricity for Gas Lighting and for other purposes; Samuel Gardiner, Jr., of New York, N. Y. The manner of supplying to a city electricity conducted through main wires having laterals running into dwellings and other places.

125,504. Improvement in Electro-Magnetic Engines; William G. Thornton, of Victoria, Texas. The invention consists principally in the transmission of electro-magnetic power through compressed air for motor purposes, and the mechanism therefor.

125,567. Improvement in Galvanic Bath for Treating Diseases; John B. Hatting, of New York, N. Y., Assignor to Henry M. Atkinson and Paul P. Todd, of same place. This invention consists in the arrangement of a metal bath tub, partly insulated, and connected with one pole of a battery, in combination with a metal plate or plates suspended or immersed in the water of the bath-tub, but insulated from the bath-tub, and connected with the other pole of the battery to cause the current of electricity to pass directly through the body of the patient operated upon.

125,582. Improvement in Electric Telegraph Apparatus; George Little, of Rutherford Park, New Jersey. Two magnets, with a vibrating armature and two electric currents regulated by rheostats; the magnets are adjustible, and are employed to move an armature carrying either a pen of peculiar construction used in receiving, or a circuit breaker in transmitting.

125,584. Improvement in Printing Telegraphs; George Little, of Rutherford Park, N. J. The inking desk applied above the type-wheel, and between that and the disk or roller in the ink-trough.

125,585. Improvement in Telegraph Receiving Apparatus; George Little, of Rutherford Park, New Jersey. A telegraphic communication received upon chemical paper in lines running back and forth, or zig-zag, and connected at alternate ends.

125,586. Improvement in Electrical Indicators; George Little, of Rutherford Park, N. J. An indicating needle, in combination with an adjustable helix that can be moved nearer to or further from the needle.

125,624. Improvement in Electro-Magnetic Watchman's Register; Horatio Sheppard, of New York, N. Y. An electrical circuit arranged to be closed or opened by the hands of a clock.

Copies of the specifications and drawings complete of any of the patents mentioned in this record—or of any other patents issued since 1886—can be had for 25 cents. Give the date and number of patent desired, and address The W. J. Johnston Co. Ltd., Potter Building, N. Y.